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ロケットプロペラントの理論性能

——多項近似式による表示——

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ロケットプロペラントの理論性能*

——多項近似式による表示——

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Polynomial Approximation of Theoretical Performance Parameters of Liquid Propellant Combinations

By Akio MORO and Kazuo SUZUKI

ABSTRACT

Polynomial approximations in three variables are presented for the calculation of theoretical performance parameters of the liquid rocket propellant combinations of liquid oxygen/liquid hydrogen, liquid oxygen/liquid methane, liquid oxygen/RP-1, liquid fluorine/liquid hydrogen, and nitrogen tetroxide/A-50.

The parameters included are the adiabatic flame temperature, characteristic velocity, specific impulse, thrust coefficient, and specific heat ratios for both equilibrium and frozen compositions during expansion. The approximations are valid for wide ranges of mixture ratios, pressures from 10 to 80 atm, and nozzle area expansion ratios, from 10 to 100, or from 50 to 200. Maximum deviation between the approximated and exact theoretical values are shown. Performance parameters given by the polynomial approximations are graphically displayed.

要　約

液体ロケットプロペラントの理論性能値（比推力，推力係数，特性排気速度）および断熱火炎温度，比熱比，平均分子量等を，酸化剤燃料混合比，燃焼室圧力，ノズル開口比を変数とする多項近似式で示し同式の適用範囲を併記した。得られた多項近似式の係数をプロペラントごとに表にして記した。また，代表2例について，理論性能値および近似式による同計算値を図表示した。表および図を巻末にまとめた。

1. まえがき

ロケットプロペラントの比推力・特性排気速度，断熱火炎温度等の理論性能計算は，V.N. Huff[1]の報告以来，最近のR.A. Svehla[2]の輸送係数の計算をも含めたものまで多数の報告がある。これらの方法で計算された結果は，グラフあるいは特定のせまい領域での表として示されている。

ロケットエンジンの燃焼性能試験のデータ整理等に際しては既存の資料を用いて理論性能をグラフから読み取ったり，表から内挿する場合，十分な精度が得られず，実験点あるいはその近傍での理論性能の計算を必要とした。しかしながら，データ処理プログラムに理論性能プログラムを含ませることは計算機容量，計算時間等の点で不経済であるため，簡単な近似式による表示が必要となった。また局所的な化学平衡を仮定した解析等においても計算時間短縮等のため断熱火炎温度，比熱比等の近似式による表示が求められた。

我々は，すでに数年来各種ロケットプロペラントについて，比推力・特性排気速度・断熱火炎温度等の計算を行ってきたが，計算結果が集積されてきたので，今回，多項近似式で整理し同式の適用範囲・誤差の大きさの目

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安等を併記した表にまとめた。また，同近似式による計算値を理論性能値とともに図表示した。本報告では，液体水素／液体酸素プロペラントを主として，液体および気体プロペラントについて記した。

2. 理論燃焼性能計算法

本報告におけるプロペラントの理論燃焼性能の計算は，すべてS. Gordon[3),4),5)]等の方法によっている。

この計算には次の仮定がなされている。

(1) 燃焼室内での燃焼過程は断熱的で，燃焼生成物は熱化学的に平衡状態にある。

(2) 燃焼ガスには，理想気体則が成立する。

(3) ノズル入口での，ガス流の速度は無視する。

(4) ノズル内の膨脹過程は等エントロピで熱損失はなく，一次元流である。

(5) 液体および固体の容積は無視でき，気体と凝縮相の間には熱力学的に平衡状態が達成され，温度差はなく，かつ速度差もない。

これらの仮定のもとに，ロケットプロペラントの理論性能特性（比推力，特性排気速度等）の値を，ノズル内の全位置において化学的に平衡な平衡流（Equilibrium flow）と化学組成が燃焼室内のままで，ノズル内の膨脹過程等でも凍結した凍結流（Frozen flow）の二つの場合について計算した。

3. 近似式

理論性能のグラフおよび表は，S. Gordon[6)]等以来多数の文献に示されている。しかし近似式による表示で公表されているものは少なく，H. J. Sternfeld[7)]等が高エネルギー推進薬について，燃焼室圧力・混合比を変数として，特性排気速度・比推力・断熱火炎温度・比熱比に関する近似式を与えているのを知るのみである。エンジン燃焼性能の高空シュミレーション試験時のノズル開口比・雰囲気圧力等の条件下では上記の近似式は適用できない。我々は，実験点の変動にともなう理論性能値を，その都度計算するかわりに燃焼室圧力・混合比・ノズル面積開口比を変数として，比推力，推力係数等を計算する近似式，および圧力・混合比を変数とする断熱火炎温度等の近似式を定め，エンジン燃焼性能を評価するためのデータ整理の簡易化を図った。

3.1 理論性能計算点

表1に，近似式の計算に用いた理論性能計算点をプロペラントごとに示す。計算点は原則として燃焼室圧力は80－10 atm，ノズル開口比は，10～100の領域内にとった。液体酸素／液体水素プロペラントについてだけは，ノズル開口比50～200の領域をも含めた。混合比に関しては，量論比点を含め8点以上を原則とした。理論性能計算結果をファイルした磁気テープより，表1の各点を検索しファイルされていない点はあらたに計算した。表1の計算点の数は，計算に要する時間と近似式の係数の数から試行の結果定めた。

3.2 関数形の選定

近似式の関数形は，計算の容易な多項式を選んだ。比推力，推力係数等の理論性能をFとすると，Fは燃焼室圧力p_c，混合比（酸化剤／燃料・重量比）O/F，およびノズル開口比AE/AT，の関数として示せる。この関数

表1 近似計算に用いた理論性能値の計算点

PROPELLANTS	PRESSURES(ATM)	NOZZLE AREA RATIOS	MIXTURE RATIOS
02(ℓ)/H2(ℓ)	80,70,60,50,40,30,20,10,	10,20,30,40,50,75,100,	2,3,4,5,6,7,8,9,
02(ℓ)/H2(ℓ)	80,70,60,50,40,30,20,10,	50,75,100,125,150,175,200,	3,4,5,6,7,8,9,
02(ℓ)/H2(g)	80,70,60,50,40,30,20,10,	10,20,30,40,50,75,100,	2,3,4,5,6,7,8,9,
02(ℓ)/RP1(ℓ)	80,70,60,50,40,30,20,10,	10,20,30,40,50,75,100,	2.25,2.5,2.75,3,3.25,3.4,3.5,3.75.4,
02(ℓ)/CH4(ℓ)	80,70,60,50,40,30,20,	10,20,30,40,50,75,	2.25,2.5,2.75,3,3.25,3.5,3.75,4,4.25,
N204(ℓ)/A-50(ℓ)	80,70,60,50,40,30,20,10,	10,20,30,40,50,75,100,	1.4,1.5,1.75,2,2.2,2.4,2.6,2.8,3,
F2(ℓ)/H2(ℓ)	80,70,60,50,40,30,20,10,	10,20,30,40,50,75,100,	4,6,8,10,12,14,16,18,20,

を係数A_{ijk}をもつ多項式で表示した。

$$F(p_c, O/F, AE/AT) = \sum_{i=L1}^{L} \sum_{j=M1}^{M} \sum_{k=N1}^{N} A_{ijk} (p_c)^{i-1} (O/F)^{j-1} (AE/AT)^{k-1} \quad \cdots\cdots (1)$$

同様に，燃焼室断熱火炎温度，特性排気速度を，燃焼室圧力p_c，および混合比O/F，を変数として，次式のように展開した。

$$G(p_c, O/F) = \sum_{i=L1}^{L} \sum_{j=M1}^{M} A_{ij} (p_c)^{i-1} (O/F)^{j-1} \quad \cdots\cdots (2)$$

式(1)および(2)について，表(1)の計算点データを用い最小二乗近似で定数，A_{ijk}およびA_{ij}を定めた。計算点の数および位置の選びかた，又，$L1$，$M1$，$N1$，L，M，N，等のとりかたによって近似度が変るが，今回は，理論性能値として，比推力，推力係数，特性排気速度について，原則として次項を満足する様にした。ただし，平衡流の比熱比$GAMMS(S)$については，多項近似の計算条件を，比推力等と同一にしたため，次項を満足していない。すなわち，計算点での理論性能値と，近似式による計算値の差が，理論性能値に対して，(1)式では１％以下，(2)式では，0.5％以下になるよう，$L1$，$M1$，$N1$，L，M，Nおよび理論計算点の位置と数を定めた。変数を，$p_c = \log p_c$，$O/F = 1/\sqrt{O/F}$等々の変数変換を行った諸式についても検討したが，係数の数の減少，近似度の大巾な向上はなかった。同じ理由で，$L1$，$M1$，$N1$はそれぞれ１をとった。比推力，推力係数，特性排気速度等のプロペラントの理論性能値は，O/Fを各プロペラントで適宜選択すれば，圧力等による変動傾向は，ほぼ同一であるので同一の関数形を採用できる。

3.3　近似結果の表示

近似計算結果と理論計算値を図１に示す。図１は，混合比を横軸とし，ノズル開口比を指定した場合の比推力を示す。実曲線は，最小二乗近似による多項式での計算結果である。同曲線上の１～４の数字は，それぞれ表１に示した計算点の，同図の該当点における，１…平衡流真空比推力，２…凍結流真空比推力，３…平衡流地上比推力，４…凍結流地上比推力の理論値を示している。平衡流は添字S，凍結流は添字F，真空は(V)，地上は(A)の記号で示した。この表示は，図２の推力係数でも同様である。図３に特性排気速度を示す。図４は比熱比である。なお，巻末付録では，図の縦軸の単位表示を省略した。

近似式の係数の表示例を表２に示す。表２は比推力・推力係数等の表示および近似式の適用範囲（圧力・混合比・開口比）・近似計算値の理論計算値に対する偏差の最大値（$EMAX$）および係数の次数を，係数とともに示している。近似係数の表示は，巻末付録では，平衡流について比推力・推力係数・比熱比について記した。なお，比推力および推力係数に関しては真空値である。液体酸素／液体水素プロペラントについては，今後とも興味が多いので，表３以降にまとめて表示する。

表３は断熱火炎温度の近似係数，表４は特性排気速度の近似係数，表５は比推力の近似係数，表６は推力係数の近似係数，表７は比熱比の近似係数，表８は平均分子量の近似係数である。表５～８では，ノズル開口比10－100の領域で適用する係数と，50－200の領域での係数を分けて示した。

表１の各プロペラントの近似係数を，巻末付録Ａに，ノズル開口比50，燃焼室圧力80 atmおよび10 atmの場合の理論計算値と多項近似式によるグラフ（図１～３参照）とともに同一ページにまとめた。このグラフで実線は多項近似式で連続プロットしたもので，数字は同近似式の計算に用いた理論性能値である。近似式の係数は，特性排気速度では平衡流について，比推力，推力係数では，真空中の平衡流の係数のみを記した。また近似式の計算に用いた理論性能値のグラフ表示した開口比での燃焼室圧力の影響を知るための参考として，図表示圧力の間の，40 atm，60 atmの値を表示した。液体酸素／液体水素のプロペラントについては，表(1)に示したすべての理論性能計算点について，各ノズル開口比ごとに，４点の燃焼室圧力のグラフ４種を１ページとし，巻末付録Ｂとして付した。

3.4　近似式の使用例

燃焼室圧力$p_c = P$，混合比$R = O/F$，ノズル開口比$AE/AT = E$，雰囲気圧力P_aとすると，液体酸素／液体水素系プロペラントの理論特性排気速度，理論推力係数は，表４および表６－１の係数を用いて図５，図６のように求まる。これらの係数を用いる事により液体酸素／液体水素系プロペラントでの高空燃焼性能試験での特性排気速度効率，推力効率等の計算の簡易化が図れる。

3.5　むすび

液体酸素／液体水素プロペラントを主として，理論性能値の多項近似式を定めた。これらの近似式を使用する事によりエンジン燃焼性能を評価するためのデータ整理の簡易化ができた。また理論性能値の図表示を見易く，正確にし使用の便を図った。

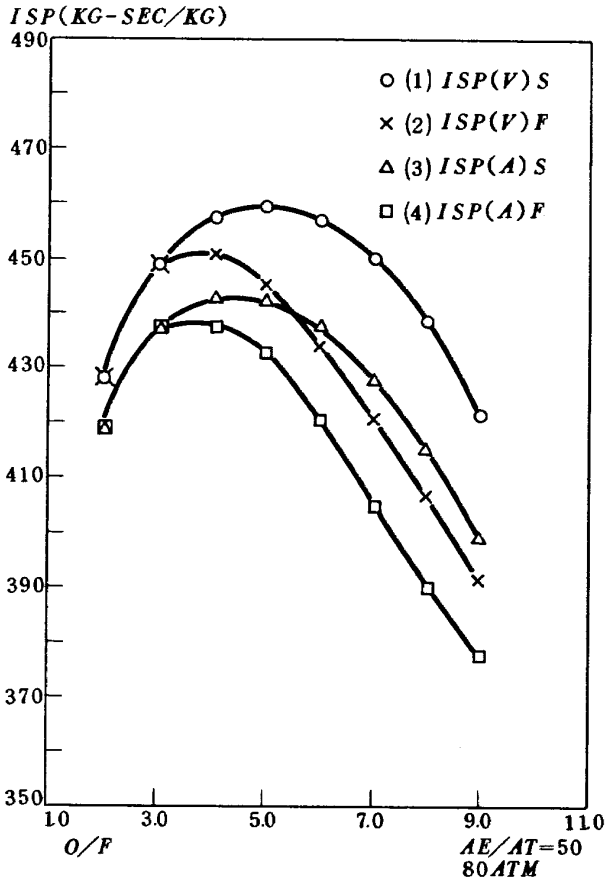


図 1　液体酸素／液体水素推進薬の比推力

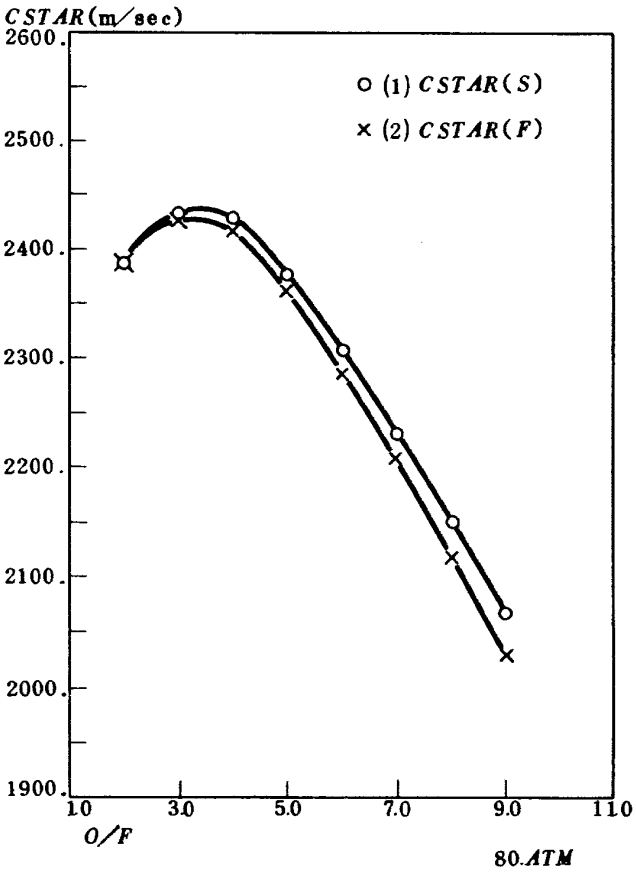


図 3　液体酸素／液体水素推進薬の特性排気速度

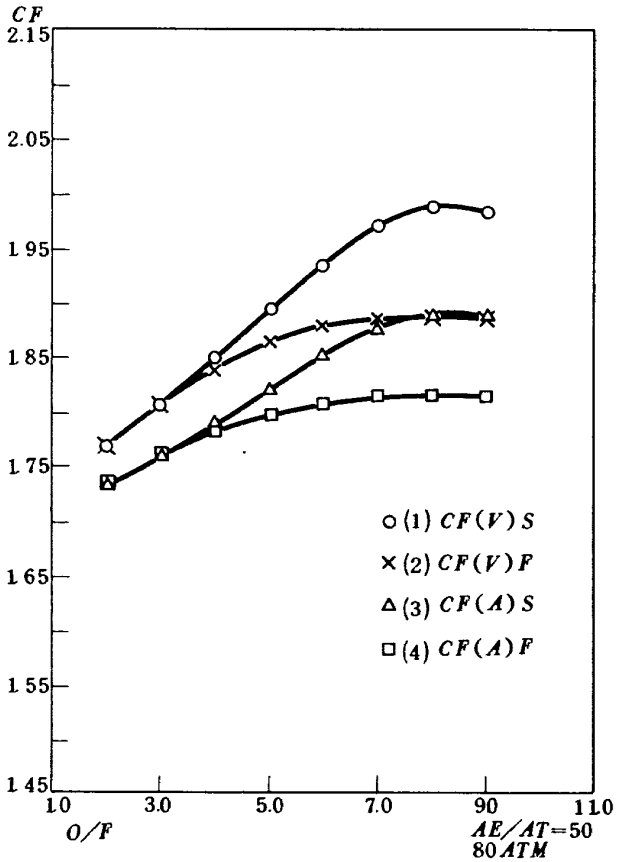


図 2　液体酸素／液体水素推進薬の推力係数

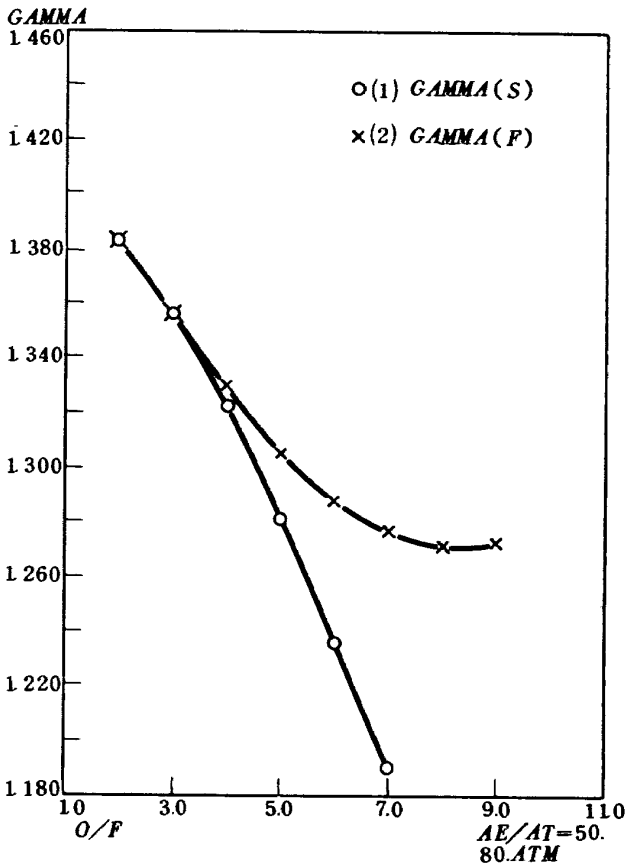


図 4　液体酸素／液体水素推進薬の比熱比

表２　多項近似係数表示例，比推力（平衡流）液体酸素／液体水素

******* ISP(V) ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) *******

PC=80.ATM - 10.ATM, O/F=2.0 - 9.0, AE/AT=10. - 100. (EMAX.LT.0.7%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3128847E 03	0.1231634E 01	-0.4203212E-01	0.6661819E-03	-0.3183335E-05
J= 2	0.5366855E 02	0.9602607E 00	-0.1417169E-01	0.1777238E-04	0.2729441E-06
J= 3	-0.1037008E 02	-0.1919829E 00	0.2635736E-02	0.1105778E-05	-0.7312002E-07
J= 4	0.5925525E 00	0.2835395E-01	-0.4321769E-03	0.1705344E-05	-0.5986276E-09
J= 5	-0.7164697E-02	-0.1670222E-02	0.2808378E-04	-0.1917518E-06	0.5537840E-09

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.3902516E-02	-0.1755195E-02	-0.1064326E-03	0.3205261E-05	-0.2359655E-07
J= 2	-0.2272652E-01	0.5898851E-02	-0.5976518E-04	-0.6397327E-06	0.1000854E-07
J= 3	0.7420825E-02	-0.2895901E-02	0.5789054E-04	-0.3664604E-06	-0.3175696E-09
J= 4	0.2419713E-04	0.4499844E-03	-0.1074809E-04	0.9663645E-07	-0.2085601E-09
J= 5	-0.4929365E-04	-0.2225637E-04	0.5807030E-06	-0.5857325E-08	0.1709919E-10

表３　断熱火炎温度近似式係数　液体酸素／液体水素

******* TEMP(AD) ****** ((A(I,J),J=1,5),I=1,3) *********

PC=80.ATM -10.ATM, O/F=2.0 -9.0 (EMAX.LT.0.5%)
A(I,J)*(PC)**(I-1)*(AE/AT)**(J-1)

	J=1	J=2	J=3	J=4	J=5
I=1	-0.4761292E 03	0.1543562E 04	-0.2332651E 03	0.1529951E 02	-0.3692744E 00
I=2	0.1201824E 02	-0.1272431E 02	0.4335977E 01	-0.5115701E 00	0.2020336E-01
I=3	-0.7521740E-01	0.8068268E-01	-0.2808511E-01	0.3395098E-02	-0.1375770E-03

表4　特性排気速度近似式係数　液体酸素／液体水素

******* CSTAR(S) ****** ((A(I,J),J=1,5),I=1,3) *********

PC=80.ATM - 10.ATM, O/F=2.0 - 9.0 (EMAX.LT.0.2%)

A(I,J)*(PC)**(I-1)*(O/F)**(J-1)

	J=1	J=2	J=3	J=4	J=5
I=1	0.1794396E 04	0.4868355E 03	-0.1226457E 03	0.1131721E 02	-0.3769838E 00
I=2	0.3682019E 01	-0.3697224E 01	0.1183846E 01	-0.1376305E 00	0.5407121E-02
I=3	-0.2552138E-01	0.2595783E-01	-0.8469601E-02	0.1013546E-02	-0.4116665E-04

******* CSTAR(F) ****** ((A(I,J),J=1,5),I=1,3) ********

PC=80.ATM -10.ATM, O/F=2.0 - 9.0 (EMAX.LT.0.3%)

A(I,J)*(PC)**(I-1)*(O/F)**(J-1)

	J=1	J=2	J=3	J=4	J=5
I=1	0.1763360E 04	0.5436596E 03	-0.1503731E 03	0.1532176E 02	-0.5613705E 00
I=2	0.2177692E 01	-0.2665075E 01	0.1027184E 01	-0.1318434E 00	0.5561806E-02
I=3	-0.1105323E-01	0.1471530E-01	-0.6027072E-02	0.7945651E-03	-0.3406890E-04

表5-1　比推力(平衡流)近似式係数，液体酸素／液体水素(ノズル開口比10.-100.)

******** ISP(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.7%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3128847E 03	0.1231634E 01	-0.4203212E-01	0.6661819E-03	-0.3183235E-05
J= 2	0.5366855E 02	0.9602607E 00	-0.1417169E-01	0 1777238E-04	0.2729041E-06
J= 3	-0.1037008E 02	-0.1919829E 00	0.2635736E-02	0.1105778E-05	-0.7312002E-07
J= 4	0.5925525E 00	0.2835395E-01	-0.4321769E-03	0.1705344E-05	-0.5986276E-09
J= 5	-0.7164697E-02	-0.1670222E-02	0.2808378E-04	-0.1917518E-06	0.5537840E-09

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.3902516E-02	-0.1755195E-02	-0.1064326E-03	0.3205261E-05	-0.2359655E-07
J= 2	-0.2272652E-01	0.5898851E-02	-0.5976518E-04	-0.6397327E-06	0.1000854E-07
J= 3	0.7420825E-02	-0.2895901E-02	0.5789054E-04	-0.3664604E-06	-0.3175696E-09
J= 4	0.2419713E-04	0.4499844E-03	-0.1074809E-04	0.9663645E-07	-0.2085601E-09
J= 5	-0.4929365E-04	-0.2225637E-04	0.5807030E-06	-0.5857325E-08	0.1709919E-00

******** ISP(A)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2)

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX LT.0.8%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.2909899E 03	0.2306153E 01	-0.6901099E-01	0.1060022E-02	-0.4999592E-05
J= 2	0.4959693E 02	0.1054655E 01	-0.1935122E-01	0.2857535E-04	0.3434272E-06
J= 3	-0.1057213E 02	-0.1783239E 00	0.4181578E-02	-0.1159070E-04	-0.3095535E-07
J= 4	0.6417319E 00	0.2206066E-01	-0.5864999E-03	0.3634387E-05	-0.9315019E-08
J= 5	-0.7390276E-02	-0.1286694E-02	0.3420436E-04	-0.2913827E-06	0.1056141E-08

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.9249252E-01	-0.1580368E-02	-0.1796420E-03	0.4589046E-05	-0.3101835E-07
J= 2	-0.1197284E 00	0.6718285E-02	-0.2112358E-04	-0.1521051E-05	0.1500481E-07
J= 3	0.4236812E-01	-0.3522127E-02	0.5680542E-04	-0.2672019E-06	-0.1206887E-08
J= 4	-0.4775033E-02	0.5734723E-03	-0.1197061E-04	0.9832775E-07	-0.1784902E-09
J= 5	0.1716675E-03	-0.2924958E-04	0.6845471E-06	-0.6603925E-08	0.1885557E-10

表 5-2　比推力(凍結流) 近似式係数, 液体酸素／液体水素 (ノズル開口比 10.-100.)

******** ISP(V)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.9%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.2717330E 03	0.1294417E 01	-0.3890295E-01	0.4902355E-03	-0.2124626E-05
J= 2	0.9762994E 02	0.8302757E 00	-0.1267706E-01	0.8007523E-04	-0.1535727E-06
J= 3	-0.2561096E 02	-0.1145982E 00	0.1317619E-02	-0.2020128E-05	-0.2674405E-07
J= 4	0.2529182E 01	0.4868722E-02	-0.5037492E-05	-0.9653694E-06	0.6649971E-08
J= 5	-0.9036833E-01	-0.2887826E-04	-0.2013639E-05	0.4825126E-07	-0.2607639E-09

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.2251177E 00	-0.1265163E-02	0.1523107E-03	-0.2613309E-05	0.1308160E-07
J= 2	-0.2367859E 00	-0.1435101E-02	-0.5290406E-04	0.1233262E-05	-0.6749506E-08
J= 3	0.8116728E-01	0.1216343E-02	-0.1008441E-04	-0.2416677E-07	0.4711398E-09
J= 4	-0.9633982E-02	-0.2118085E-03	0.3670907E-05	-0.3136102E-07	0.1005198E-09
J= 5	0.3782212E-03	0.1119111E-04	-0.2465568E-06	0.2635268E-08	-0.1033015E-10

******** ISP(A)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.9%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.2601237E 03	0.1976592E 01	-0.5788533E-01	0.7000781E-03	-0.2905573E-05
J= 2	0.8446444E 02	0.1201150E 01	-0.1858374E-01	0.1356365E-03	-0.3962392E-06
J= 3	-0.2324817E 02	-0.1895440E 00	0.2325503E-02	-0.1048319E-04	0.1336002E-07
J= 4	0.2370741E 01	0.1014977E-01	-0.4209678E-04	-0.8638973E-06	0.5447700E-08
J= 5	-0.8695567E-01	-0.1401727E-03	-0.3073456E-05	0.7315078E-07	-0.3262755E-09

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.2324263E 00	-0.4228862E-02	0.2107467E-03	-0.2810613E-05	0.1157724E-07
J= 2	-0.2356338E 00	0.1239001E-02	-0.1109139E-03	0.1514676E-05	-0.5942116E-08
J= 3	0.7818169E-01	0.4870942E-03	0.6099234E-05	-0.9994569E-07	0.2074739E-09
J= 4	-0.9176293E-02	-0.1342496E-03	0.2004012E-05	-0.2563345E-07	0.1472985E-09
J= 5	0.3580976E-03	0.8359301E-05	-0.1897179E-06	0.2563864E-08	-0.1307311E-10

表5-3　比推力(平衡流)近似式係数，液体酸素／液体水素(ノズル開口比 50.-200.)

******* ISP(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.8%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3388389E 03	0.5978323E 00	-0.3643784E-02	-0.8057142E-05	0.5395729E-07
J= 2	0.5774143E 02	-0.2066769E 00	0.1329201E-02	0.1096213E-04	-0.4818563E-07
J= 3	-0.1113607E 02	0.7595155E-01	-0.6314682E-03	-0.1726383E-05	0.1113282E-07
J= 4	0.7793920E 00	-0.6115159E-02	0.6304544E-04	0.2279357E-06	-0.1341361E-08
J= 5	-0.2127235E-01	0.7529941E-04	-0.1525829E-05	-0.1374200E-07	0.6320305E-10

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.2126201E 00	-0.9649653E-02	0.7938537E-04	-0.4808983E-06	0.1356823E-08
J= 2	-0.1188763E 00	0.6465705E-02	-0.4485902E-04	0.2617496E-06	-0.8000816E-09
J= 3	0.8187058E-02	-0.1140015E-02	0.3181883E-05	-0.1651158E-07	0.1022038E-09
J= 4	0.2802621E-02	0.3791802E-04	0.9370927E-06	-0.5778087E-08	0.4150144E-11
J= 5	-0.2731291E-03	0.2537800E-05	-0.9511396E-07	0.5671636E-09	-0.8463216E-12

******* ISP(A)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.3%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3715088E 03	0.2837832E 00	-0.9206477E-03	-0.1212934E-04	0.4278514E-07
J= 2	0.2089657E 02	0.1288419E 00	-0.1398599E-02	0.1570673E-04	-0.3989951E-07
J= 3	-0.1866510E 01	0.1178536E-01	-0.1614320E-03	-0.1608242E-05	0.6012036E-08
J= 4	-0.3094870E 00	-0.1605753E-02	0.4034763E-04	0.4928488E-07	-0.4188198E-09
J= 5	0.2622153E-01	-0.6012354E-05	-0.1815349E-05	0.2261186E-09	0.1176163E-10

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.5306187E-02	-0.2283799E-03	-0.5978309E-04	0.3984696E-06	-0.6302222E-09
J= 2	-0.2256419E-01	0.1961477E-02	0.2471788E-04	-0.1976125E-06	0.2816119E-09
J= 3	0.9032034E-02	-0.9967118E-03	-0.1118468E-05	0.2494156E-07	-0.2265559E-10
J= 4	-0.7071454E-03	0.1614801E-03	-0.4671792E-06	0.2546543E-09	-0.3302256E-11
J= 5	0.1144900E-04	-0.8435097E-05	0.4260260E-07	-0.1350637E-09	0.3748888E-12

表5-4　比推力(凍結流)近似式係数，液体酸素／液体水素(ノズル開口比 50.-200.)

******* ISP(V)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.9%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3246075E 03	-0.2610213E-02	-0.8273511E-02	0.7279245E-04	-0.1648034E-06
J= 2	0.7482723E 02	0.4025537E 00	0.2309349E-02	-0.3582357E-04	0.8885153E-07
J= 3	-0.1697741E 02	-0.1173180E 00	-0.2700915E-03	0.7035551E-05	-0.1790765E-07
J= 4	0.1311001E 01	0.1617918E-01	-0.2556077E-04	-0.4305689E-06	0.1228536E-08
J= 5	-0.3315337E-01	-0.8162349E-03	0.3626240E-05	0.1510360E-08	-0.1593220E-10

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.1759245E 00	0.4009361E-03	0.1378490E-03	-0.1184592E-05	0.2607239E-08
J= 2	0.1562062E 00	-0.4526142E-02	-0.4663626E-04	0.5631156E-06	-0.1289986E-08
J= 3	-0.5375005E-01	0.2587943E-02	-0.6337529E-05	-0.4260315E-07	0.1252690E-09
J= 4	0.9222561E-02	-0.4507063E-03	0.2909233E-05	-0.7810339E-08	0.1151581E-10
J= 5	-0.5255342E-03	0.2448725E-04	-0.2045944E-06	0.8150400E-09	-0.1479074E-11

******* ISP(A)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.9%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3157216E 03	0.2789218E 00	-0.1075777E-01	0.7968062E-04	-0.1664637E-06
J= 2	0.7122274E 02	0.3168572E 00	0.3014165E-02	-0.3531106E-04	0.7922704E-07
J= 3	-0.1716786E 02	-0.8708780E-01	-0.4414502E-03	0.6426775E-05	-0.1388845E-07
J= 4	0.1414670E 01	0.1257777E-01	-0.1554600E-04	-0.2688035E-06	0.5347187E-09
J= 5	-0.3915536E-01	-0.6848294E-03	0.3825553E-05	-0.9910074E-08	0.2386338E-10

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.6639447E-01	-0.4996889E-02	0.2166012E-03	-0.1672087E-05	0.3664355E-08
J= 2	0.1060415E 00	-0.1719679E-02	-0.8615756E-04	0.8067290E-06	-0.1820756E-08
J= 3	-0.5331423E-01	0.2366771E-02	-0.3724854E-05	-0.5954160E-07	0.1661571E-09
J= 4	0.1071478E-01	-0.4951060E-03	0.3651633E-05	-0.1212418E-07	0.1984030E-10
J= 5	-0.6471026E-03	0.2919329E-04	-0.2779560E-06	0.1248458E-08	-0.2351698E-11

表6－1　推力係数（平衡流）近似式係数，液体酸素／液体水素（ノズル開口比 10.－100.）

******** CF(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.5%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1664265E 01	0.6048426E-02	-0.1874941E-03	0.2777676E-05	-0.1284132E-07
J= 2	-0.8375024E-01	0.3249812E-02	-0.4436937E-04	-0.1096897E-07	0.1218508E-08
J= 3	0.3135537E-01	-0.7128649E-03	0.8202037E-05	0.2515914E-07	-0.3459696E-09
J= 4	-0.4038109E-02	0.1289445E-03	-0.1777062E-05	0.6616276E-08	-0.1447118E-11
J= 5	0.1734374E-03	-0.7925928E-05	0.1212898E-06	-0.7856137E-09	0.2151843E-11

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.1023136E-02	-0.1259952E-04	-0.4376120E-07	0.4617410E-08	-0.6228218E-10
J= 2	0.9317061E-03	0.2646144E-04	-0.4485801E-06	0.2280200E-08	0.2267969E-10
J= 3	-0.2841119E-03	-0.1233426E-04	0.2845470E-06	-0.2673169E-08	0.2839920E-11
J= 4	0.3450935E-04	0.1863628E-05	-0.4896802E-07	0.5231500E-09	-0.1295564E-11
J= 5	-0.1453785E-05	-0.9108608E-07	0.2587927E-08	-0.2937523E-10	0.8895437E-13

******** CF(A)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.5%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1538746E 01	0.1196689E-01	-0.3175872E-03	0.4418353E-05	-0.1941505E-07
J= 2	-0.7304155E-01	0.2311985E-02	-0.4742607E-04	-0.9180251E-08	0.8710410E-09
J= 3	0.2412631E-01	-0.2750917E-03	0.9183837E-05	-0.1435231E-07	0.1282034E-10
J= 4	-0.3339855E-02	0.6116729E-04	-0.1860959E-05	0.1430508E-07	-0.6551574E-10
J= 5	0.1597504E-03	-0.4726719E-05	0.1277040E-06	-0.1251170E-08	0.5732132E-11

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.5392833E-03	-0.1347972E-04	-0.3811952E-06	0.1148558E-07	-0.1027582E-09
J= 2	0.4129390E-03	0.3201326E-04	-0.2566282E-06	-0.2576635E-08	0.5308566E-10
J= 3	-0.1020318E-03	-0.1586109E-04	0.2702786E-06	-0.1690535E-08	-0.4329395E-11
J= 4	0.1053367E-04	0.2494416E-05	-0.5201621E-07	0.4557008E-09	-0.6339506E-12
J= 5	-0.3974046E-06	-0.1241817E-06	0.2866237E-08	-0.2812017E-10	0.6730995E-13

表6-2　推力係数（平衡流）近似式係数，液体酸素／液体水素（ノズル開口比 10.-100.）

******** CF(V)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.3%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1533832E 01	0.6904544E-02	-0.1732104E-03	0.1964959E-05	-0.7997632E-08
J= 2	0.4327643E-01	0.1972684E-02	-0.3791128E-04	0.3362448E-06	-0.1104445E-08
J= 3	-0.8500195E-02	-0.8732522E-04	0.1710472E-05	-0.1232108E-07	0.2812762E-10
J= 4	0.7429216E-03	-0.1277489E-04	0.1725142E-06	-0.1162134E-08	0.2706192E-11
J= 5	-0.2396091E-04	0.8913121E-06	-0.9767981E-08	0.2170453E-10	0.1584371E-12

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.1170762E-03	-0.9054822E-05	0.5377323E-06	-0.7875637E-08	0.3623672E-10
J= 2	-0.9236770E-04	0.3274642E-05	-0.3172976E-06	0.4777731E-08	-0.2193850E-10
J= 3	0.2344840E-04	0.5517895E-06	0.4105095E-07	-0.6736370E-09	0.3050738E-11
J= 4	-0.2088431E-05	-0.1829241E-06	0.1933054E-09	0.3582144E-11	0.4579632E-14
J= 5	0.5192542E-07	0.1189163E-07	-0.212037.7E-09	0.3007851E-11	-0.1549639E-13

******** CF(A)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.3%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1449207E 01	0.1077298E-01	-0.2703854E-03	0.3036907E-05	-0.1225277E-07
J= 2	0.2021766E-01	0.2565903E-02	-0.4285075E-04	0.3287528E-06	-0.9048090E-09
J= 3	-0.6745398E-02	-0.1750790E-03	0.1147869E-05	0.1570237E-07	-0.1490779E-09
J= 4	0.8007914E-03	-0.6358083E-05	0.3299257E-06	-0.5846412E-08	0.3083991E-10
J= 5	-0.3153343E-04	0.6436009E-06	-0.1638551E-07	0.2297694E-09	-0.1128408E-11

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.6742991E-04	-0.8839725E-05	0.5217288E-06	-0.7009470E-08	0.2894422E-10
J= 2	-0.4666381E-04	0.5626425E-05	-0.4270306E-06	0.5898662E-08	-0.2453986E-10
J= 3	0.3123477E-06	0.1551361E-06	0.7359177E-07	-0.1094386E-08	0.4493809E-11
J= 4	0.1963341E-05	-0.2516153E-06	-0.8284461E-09	0.2627478E-10	-0.7867634E-13
J= 5	-0.1795077E-06	0.2150809E-07	-0.3600315E-09	0.4181186E-11	-0.2012822E-13

表 6-3　推力係数（凍結流）近似式係数，液体酸素／液体水素（ノズル開口比 50.-200.）

******* CF(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.7%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1586839E 01	0.5135672E-02	-0.4030120E-05	-0.2621517E-06	0.8415468E-09
J= 2	0.8644502E-01	-0.3121879E-02	0.1339921E-05	0.1921787E-06	-0.6098247E-09
J= 3	-0.1777099E-01	0.9672495E-03	-0.2496077E-05	-0.3972213E-07	0.1407744E-09
J= 4	0.2490552E-02	-0.1024119E-03	0.3430056E-06	0.3946742E-08	-0.1468794E-10
J= 5	-0.1360830E-03	0.3618703E-05	-0.1358715E-07	-0.1520391E-09	0.5718153E-12

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.1817006E-02	-0.9545292E-04	0.4644013E-06	-0.1168754E-08	0.3510454E-11
J= 2	-0.1119442E-02	0.7144649E-04	-0.3296046E-06	0.7351610E-09	-0.2360233E-11
J= 3	0.1988113E-03	-0.1734881E-04	0.6275793E-07	-0.4995250E-10	0.3451967E-12
J= 4	-0.1169597E-04	0.1648891E-05	-0.2837944E-08	-0.1826739E-10	0.7430096E-14
J= 5	0.5680782E-07	-0.5216766E-07	-0.8215457E-10	0.1843311E-11	-0.2439116E-14

******* CF(A)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.7%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1714517E 01	0.4416637E-02	0.7827865E-06	-0.2422335E-06	0.7214310E-09
J= 2	-0.6781660E-01	-0.1958753E-02	-0.8326727E-05	0.2036893E-06	-0.5616122E-09
J= 3	0.2290910E-01	0.7409578E-03	-0.6958352E-06	-0.3871127E-07	0.1193797E-09
J= 4	-0.2485854E-02	-0.8818463E-04	0.2747061E-06	0.3060417E-08	-0.1063768E-10
J= 5	0.8461085E-04	0.3528702E-05	-0.1717346E-07	-0.7855211E-10	0.3274036E-12

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.1107972E-02	-0.5802844E-04	-0.1089762E-06	0.2576379E-08	-0.5302147E-11
J= 2	-0.8219379E-03	0.5296035E-04	-0.3358793E-07	-0.1282617E-08	0.2614308E-11
J= 3	0.2163849E-03	-0.1664942E-04	0.4292667E-07	0.1412163E-09	-0.2670266E-12
J= 4	-0.2624305E-04	0.2145718E-05	-0.8717090E-08	0.7822793E-11	-0.2162941E-13
J= 5	0.1169494E-05	-0.9690236E-07	0.5040541E-09	-0.1260170E-11	0.2955982E-14

表6－4　推力係数（凍結流）近似式係数，液体酸素／液体水素（ノズル開口比 50.－200.）

******* CF(V)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM－10.ATM, O/F=2.0－9.0, AE/AT=10.－100. (EMAX.LT.0.3%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1522719E 01	0.1848929E-02	-0.1351384E-04	0.4271646E-07	-0.5352145E-20
J= 2	0.1237953E 00	0.8481773E-04	-0.2873675E-05	0.2303796E-07	-0.4749394E-20
J= 3	-0.2306141E-01	0.3830564E-04	0.4650830E-06	-0.4917515E-08	0.9899960E-21
J= 4	0.1952657E-02	-0.6761516E-05	-0.3265620E-07	0.3978541E-09	-0.6692571E-22
J= 5	-0.6344373E-04	0.3220340E-06	0.3923120E-09	-0.7407685E-11	0.2857028E-24

I=2	K=2	K=2	K=3	K=4	K=5
J= 1	0.8971946E-03	-0.1575020E-04	0.1252485E-06	-0.4328682E-09	0.7510364E-12
J= 2	-0.5627264E-03	0.6242124E-05	-0.3653926E-07	0.8366518E-10	-0.2242692E-12
J= 3	0.1315869E-03	-0.6826301E-06	0.1759750E-08	-0.1778306E-11	0.6003915E-13
J= 4	-0.1340107E-04	0.4537151E-07	-0.2772021E-09	0.3261941E-11	-0.1735001E-13
J= 5	0.5100120E-06	-0.2486246E-08	0.3878437E-10	-0.3876202E-12	0.1383334E-14

******* CF(A)F ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM－10.ATM, O/F=2.0－9.0,AE/AT=10.－100. (EMAX.LT.0.3%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1514690E 01	0.2368411E-02	-0.2436153E-04	0.1140330E-06	-0.2042511E-09
J= 2	0.8476342E-01	0.3207714E-03	-0.4504287E-06	-0.3936567E-08	0.1647960E-10
J= 3	-0.1736302E-01	0.1605454E-04	-0.3284629E-06	0.1555274E-08	-0.2954051E-11
J= 4	0.1612223E-02	-0.6697639E-05	0.4431075E-07	-0.4932781E-10	-0.1741241E-12
J= 5	-0.5549992E-04	0.2951502E-06	-0.5440317E-09	-0.1094557E-10	0.4332696E-13

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.1219577E-03	-0.2699904E-05	0.7785292E-07	-0.6134375E-09	0.1677431E-11
J= 2	-0.3187751E-04	-0.2357284E-05	-0.8642234E-08	0.2229964E-09	-0.8428633E-12
J= 3	0.1055935E-04	0.1076107E-05	-0.2620395E-08	-0.3410167E-10	0.1713150E-12
J= 4	-0.9197511E-06	-0.1587467E-06	0.9177124E-09	-0.3699532E-12	-0.8940027E-14
J= 5	-0.1768257E-07	0.9225146E-08	-0.8491591E-10	0.3368690E-12	-0.4014507E-15

表 7－1　比熱比（平衡流，凍結流）近似式係数，液体酸素／液体水素（ノズル開口比 10.－100.）

******** GAMMA (S)　　****** (((A(I,J,K),K=1,5),J=1,5),I=1,2)　　**********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100.　　(EMAX.LT.1.7%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1571813E 01	-0.4781044E-03	-0.6359758E-04	0.2822909E-05	-0.1450066E-07
J= 2	-0.1830110E 00	0.2718159E-02	-0.6097969E-04	-0.5545787E-06	0.3681952E-08
J= 3	0.4845387E-01	-0.5961810E-03	0.2570753E-04	-0.3672674E-07	-0.4654839E-10
J= 4	-0.7261418E-02	0.6861900E-04	-0.4030569E-05	0.2278437E-07	-0.8297757E-10
J= 5	0.3900810E-03	-0.3858918E-05	0.2271046E-06	-0.1794825E-08	0.7147035E-11

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.5378334E-03	-0.1994091E-04	-0.5892859E-06	0.1477539E-07	-0.1345627E-09
J= 2	-0.5958951E-03	0.3829471E-04	-0.1562590E-06	-0.3636355E-08	0.6847649E-10
J= 3	0.1958575E-03	-0.1789623E-04	0.2874875E-06	-0.2392237E-08	-0.2935422E-11
J= 4	-0.2158077E-04	0.2751077E-05	-0.6097632E-07	0.6939882E-09	-0.1672924E-11
J= 5	0.7257836E-06	-0.1317092E-06	0.3476915E-08	-0.4447999E-10	0.1479395E-12

******** GAMMA (F)　　****** (((A(I,J,K),K=1,5),J=1,5),I=1,2)　　**********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100.　　(EMAX.LT.0.4%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1470418E 01	-0.3859157E-02	0.5883360E-04	-0.1247501E-06	-0.1129628E-08
J= 2	-0.5473876E-01	0.3836355E-02	-0.6910183E-04	0.3497625E-06	-0.8797132E-10
J= 3	-0.4847961E-02	-0.5604178E-03	0.9334563E-05	-0.1584597E-08	-0.3248918E-09
J= 4	0.1876903E-02	0.1420606E-04	0.3719339E-07	-0.1120381E-07	0.8019179E-10
J= 5	-0.1107513E-03	0.1094375E-05	-0.4050560E-07	0.8647670E-09	-0.4816768E-11

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.6191737E-04	-0.3524524E-04	0.8961964E-06	-0.8531218E-08	0.2714136E-10
J= 2	0.1719767E-03	0.2580137E-04	-0.5858716E-06	0.4450533E-08	-0.9035252E-11
J= 3	-0.8860012E-04	-0.5534343E-05	0.1011237E-06	-0.2887246E-09	-0.2189223E-11
J= 4	0.1358581E-04	0.3321936E-06	-0.1570324E-08	-0.1074835E-09	0.9141157E-12
J= 5	-0.6741544E-06	0.1042331E-08	-0.4118303E-09	0.1088515E-10	-0.6737718E-13

表7-2　比熱比（平衡流，凍結流）近似式係数，液体酸素／液体水素（ノズル開口比 50.-200.）

******* GAMMA (S) ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.2.3%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.2308274E 01	-0.4112493E-02	0.6700183E-04	-0.5049511E-06	0.1038266E-08
J= 2	-0.6884934E 00	0.1488863E-02	-0.3242706E-04	0.2945607E-06	-0.6272122E-09
J= 3	0.1749393E 00	0.2721499E-03	0.1576548E-05	-0.4570135E-07	0.1092338E-09
J= 4	-0.2017868E-01	-0.1071945E-03	0.6461602E-06	0.1338170E-08	-0.5625817E-11
J= 5	0.8434014E-03	0.7416420E-05	-0.5900129E-07	0.9567615E-10	-0.3183462E-13

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.7681364E-03	0.2611468E-04	-0.1696474E-05	0.1262516E-07	-0.2410514E-10
J= 2	-0.4953624E-03	0.2804203E-04	0.6716084E-06	-0.6222310E-08	0.1165757E-10
J= 3	0.4586852E-03	-0.2209973E-04	0.6448693E-08	0.6542077E-09	-0.1126037E-11
J= 4	-0.9041744E-04	0.4181225E-05	-0.2199752E-07	0.4100581E-10	-0.9891313E-13
J= 5	0.5205629E-05	-0.2355888E-06	0.1715772E-08	-0.6087813E-11	0.1269914E-13

******* GAMMA (F) ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.4%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1490279E 01	-0.1651406E-02	0.4674113E-05	0.4269882E-07	-0.1571470E-09
J= 2	-0.4884855E-01	0.1003747E-02	-0.2078163E-05	-0.3487995E-07	0.1172095E-09
J= 3	-0.2243352E-02	-0.1298692E-03	-0.1877346E-06	0.1048898E-07	-0.3019603E-10
J= 4	0.9528540E-03	0.9711066E-05	0.1072841E-07	-0.8881099E-09	0.2530817E-11
J= 5	-0.4699881E-04	-0.4492691E-06	0.2315435E-08	0.1366126E-10	-0.4936121E-13

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.7587243E-03	-0.9007212E-05	0.1776705E-06	-0.9757767E-09	0.1496489E-11
J= 2	0.7372828E-03	0.3799692E-05	-0.9278748E-07	0.4766938E-09	-0.5559357E-12
J= 3	-0.2577934E-03	0.7130077E-06	0.1244182E-08	0.1196731E-10	-0.1427983E-12
J= 4	0.3477738E-04	-0.3293309E-06	0.3287755E-08	-0.2138297E-10	0.5744834E-13
J= 5	-0.1622893E-05	0.2444892E-07	-0.2874969E-09	0.1762483E-11	-0.4163934E-14

表8-1　平均分子量(平衡流)近似式係数，液体酸素／液体水素(ノズル開口比 10.-100.)

******* MOL,W(S)　　****** (((A(I,J,K),K=1,5),J=1,5),I=1,2)　　**********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100.　　(EMAX.LT.0.5%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1958801E 01	-0.2739138E-02	0.8911030E-04	-0.1135118E-05	0.4913237E-08
J= 2	0.1987949E 01	0.1643711E-02	-0.4877375E-04	0.5796590E-06	-0.2382448E-08
J= 3	0.6340477E-01	-0.2901780E-03	0.6791408E-05	-0.6306227E-07	0.2016925E-09
J= 4	-0.1906003E-01	0.1484099E-04	-0.2795568E-07	-0.3666467E-08	0.2809385E-10
J= 5	0.8614632E-03	0.1106826E-06	-0.2797223E-07	0.5718125E-09	-0.3129722E-11

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.4886948E-02	0.4105461E-04	-0.1289276E-05	0.1613462E-07	-0.6927927E-10
J= 2	-0.4862123E-02	-0.2299523E-04	0.6253415E-06	-0.6992598E-08	0.2760724E-10
J= 3	0.1451916E-02	0.3544068E-05	-0.5764254E-07	0.2587728E-09	0.2319223E-12
J= 4	-0.1323833E-03	-0.1012646E-06	-0.5921654E-08	0.1525492E-09	-0.8827803E-12
J= 5	0.3661942E-05	-0.7429593E-08	0.7161423E-09	-0.1312509E-10	0.6844331E-13

表8-2　平均分子量(平衡流)近似式係数，液体酸素／液体水素(ノズル開口比 50.-200.)

******* MOL,W(S)　　****** (((A(I,J,K),K=1,5),J=1,5),I=1,2)　　**********

PPC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200.　　(EMAX.LT.3.4%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	-0.4234544E 01	0.4274170E-01	-0.5548813E-03	0.1192112E-05	0.1745877E-08
J= 2	0.7397630E 01	-0.3700719E-01	0.4853166E-03	-0.1138772E-05	-0.1164998E-08
J= 3	-0.1563474E 01	0.7622027E-02	-0.1005349E-03	0.1064294E-06	0.7874484E-09
J= 4	0.1906598E 00	-0.3467717E-03	0.4624430E-05	0.2934919E-07	-0.1798449E-09
J= 5	-0.8549565E-02	-0.1081488E-04	0.1457041E-06	-0.3211334E-08	0.1165262E-10

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.2583269E-01	-0.1999856E-02	0.3219118E-04	-0.2044891E-06	0.4533298E-09
J= 2	-0.4346379E-02	0.9236546E-03	-0.1581268E-04	0.1036605E-06	-0.2358256E-09
J= 3	-0.4860762E-02	-0.1016619E-04	0.8710259E-06	-0.8012220E-08	0.2258422E-10
J= 4	0.1352150E-02	-0.3019388E-04	0.3436392E-06	-0.1670530E-08	0.2706227E-11
J= 5	-0.8809925E-04	0.2547344E-05	-0.3255190E-07	0.1759134E-09	-0.3299360E-12

```
      SUBROUTINE CSTAR(R,P,CSTH)
      CSTH=(0.1794396E+4 + 0.4868355E+3*R - 0.1226457E+3*R**2 +
     1 0.1131721E+2*R**3 - 0.3769838*R**4) + (0.3682019E+1 -
     2 0.3697224E+1*R + 0.1183846E+1*R**2 - 0.1376305*R**3 +
     3 0.5407121E-2*R**4)*P + (-0.2552138E-1 + 0.2595783E-1*R -
     4 0.8469601E-2*R**2 + 0.1013546E-2*R**3 - 0.4116665E-4*R**4)*P**2
      RETURN
      END
```

図5 高空燃焼性能試験 理論性能（特性排気速度） 計算プログラム例

```
      SUBROUTINE CFSB(R,P,PA,E,CFTH)
      CFTH=(0.1664265E+1 + 0.6048426E-2*E - 0.1874941E-3*E**2 +
     1 0.2777676E-5*E**3 - 0.1284132E-7*E**4) + (-0.8375024E-1 +
     2 0.3249812E-2*E - 0.4436937E-4*E**2 - 0.1096897E-7*E**3 +
     3 0.1218508E-8*E**4)*R + (0.3135537E-1 - 0.7128649E-3*E +
     4 0.8202037E-5*E**2 + 0.2515914E-7*E**3 - 0.3459696E-9*E**4)*R**2
     5 + (-0.4038109E-2 + 0.1289445E-3*E - 0.1777062E-5*E**2 +
     6 0.6616276E-8*E**3 - 0.1447118E-11*E**4)*R**3 + (0.1734374E-3 -
     7 0.7925928E-5*E + 0.1212898E-6*E**2 - 0.7856137E-9*E**3 + 0.2151843E-11
     8 *E**4)*R**4
      CFTH = CFTH + ((-0.1023136E-2 - 0.1259952E-4*E - 0.4376120E-7*E**2 +
     1 0.467410E-8*E**3 - 0.6228218E-10*E**4) + (0.9317061E-3 + 0.2646144E-4
     2 *E - 0.4485801E-6*E**2 + 0.2280200E-8*E**3 + 0.2267969E-10*E**4)*R +
     3 (-0.2841119E-3 - 0.1233426E-4*E + 0.2845470E-6*E**2 -0.2673169E-8*E**3
     4 + 0.2839920E-11*E**4)*R**2 + (0.3450935E-4 + 0.1863628E-5*E -
     5 0.4896802E-7*E**2 + 0.5231500E-9*E**3 - 0.1295564E-11*E**4)*R**3 +
     6 (-0.1453785E-5 - 0.9108608E-7*E + 0.2587927E-8*E**2 - 0.2937523E-10*E**3
     7 + 0.8895437E-13*E**4)*R**4)*P
      CFTH = CFTH - E*PA/P
      RETURN
      END
```

図6 高空燃焼性能試験 理論性能（推力係数） 計算プログラム例

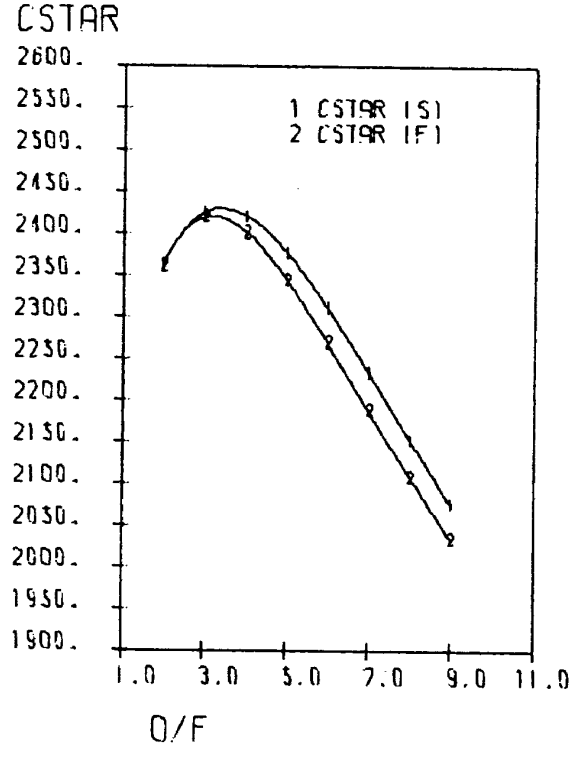
参考文献

1) V.N. Huff and S. Gordon; General Method and Thermodynamic Tables for Computation of Equilibrium Composition and Temperature of Chemical Reactions, NACA R-1037 (1951).
2) R.A. Svehla and B.J. McBride; Fortran IV Computer Program for Calculation of Thermodynamic and Transport Properties of Complex Chemical Systems, NASA TN D-7056 (1973).
3) S. Gordon and B.J. McBride; Computer Program for Calculation of Complex Chemical Equilibrium Compositions, Rocket Performance, Incident and Reflected Shocks, and Chapman-Jouguet Detonations, NASA SP-273 (1971).
4) S. Gordon and F.J. Zeleznik; A General IBM 704 or 7090 Computer Program for Computation of Chemical Equilibrium Compositions, Rocket Performance, and Chapman-Jouguet Detonations, Supplement 1 Assigned Area-Ratio Performance, NASA TN D-1737 (1963).
5) F.J. Zeleznik and S. Gordon; A General IBM 704 or 7090 Computer Program for Computation of Chemical Equilibrium Compositions, Rocket Performance, and Chapman-Jouguet Detonations, NASA TN D-1454 (1962).
6) S. Gordon and K.S. Drellishak; Theoretical Rocket Performance of JP-4 Fuel with Several Fluorine-Oxygen Mixtures Assuming Frozen Composition, NACA RM-E57GI6a, (1957).
7) H.J. Sternfeld and J. Reinkenhof; Approximate Functions for Theoretical Performance Parameters of High Energy Rocket Propellants Combinations, DLR-FB-70-77 (1970).

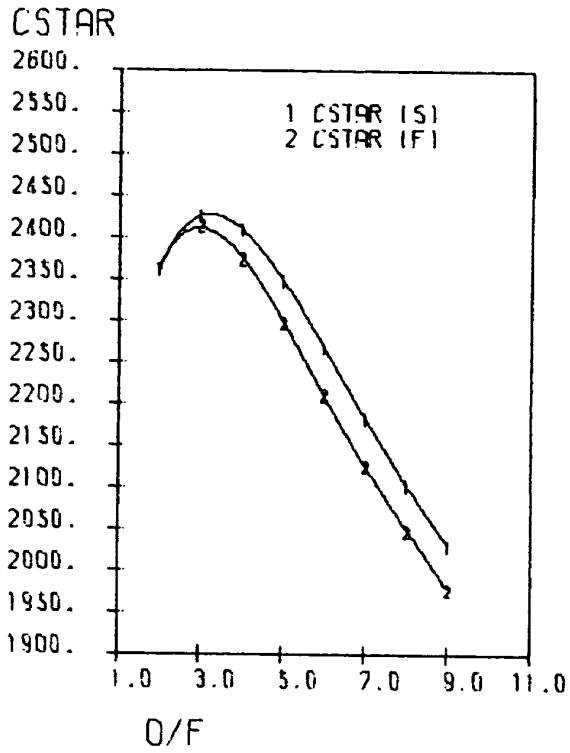
付 録 一 A

ロケットプロペラントの理論性能の多項近似式による表示例

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



80.ATM



10.ATM

******** CSTAR(S) ****** ((A(I,J),J=1,5),I=1,3) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0 (EMAX.LT.0.2%)

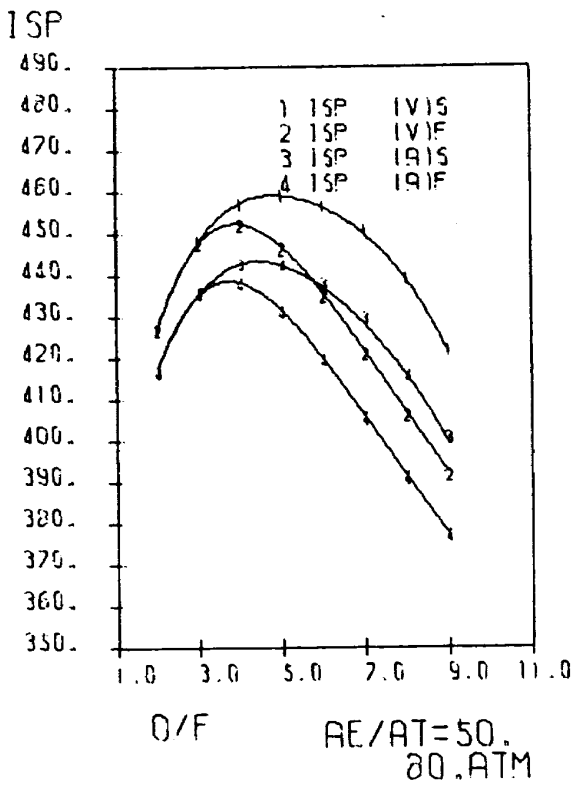
A(I,J)*(PC)**(I-1)*(O/F)**(J-1)

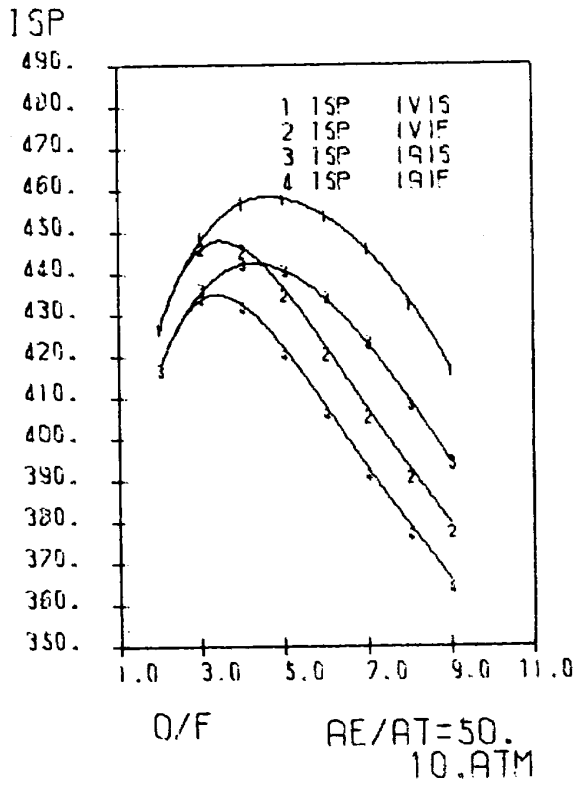
	J=1	J=2	J=3	J=4	J=5
I= 1	0.1794396E 04	0.4068355E 03	-0.1226457E 03	0.1131721E 02	-0.3769838E 00
I= 2	0.3682019E 01	-0.3697224E 01	0.1183046E 01	-0.1376305E 00	0.5407121E-02
I= 3	-0.2552130E-01	0.2595703E-01	-0.8469601E-02	0.1013546E-02	-0.4116665E-04

CSTAR EQUILIBRIUM	O/F 9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00
80. ATM	2077.	2153.	2234.	2312.	2370.	2421.	2426.	2362.
60. ATM	2071.	2146.	2227.	2306.	2374.	2420.	2426.	2362.
40. ATM	2062.	2136.	2217.	2298.	2370.	2418.	2426.	2362.
10. ATM	2030.	2102.	2182.	2267.	2348.	2410.	2426.	2362.

図 A 1 − 1

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2134.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** ISP(V)S ****** I((I9(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.2%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

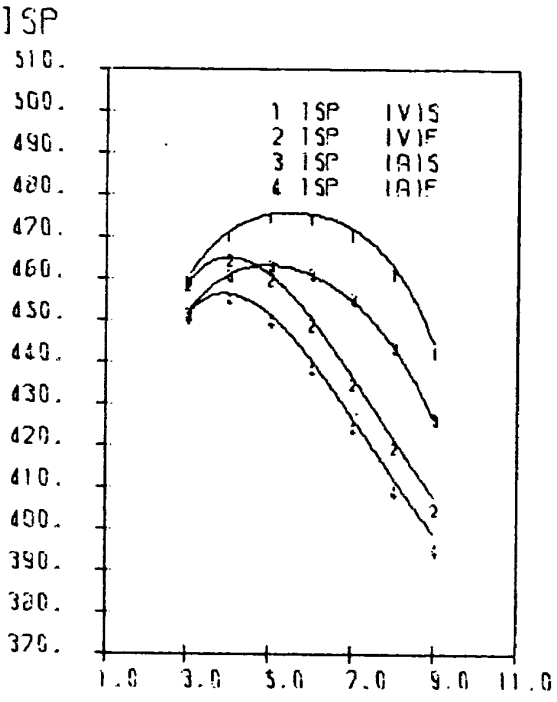
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3128847E 03	0.1231634E 01	-0.4203212E-01	0.6661819E-03	-0.3183235E-05
J= 2	0.5366855E 02	0.9602607E 00	-0.1417169E-01	0.1777238E-04	0.2729041E-06
J= 3	-0.1037000E 02	-0.1919829E 00	0.2635736E-02	0.1105778E-05	-0.7312002E-07
J= 4	0.5925525E 00	0.2835395E-01	-0.4321769E-03	0.1705344E-05	-0.5906276E-09
J= 5	-0.7164697E-02	-0.1670222E-02	0.2808370E-04	-0.1917510E-06	0.5537840E-09

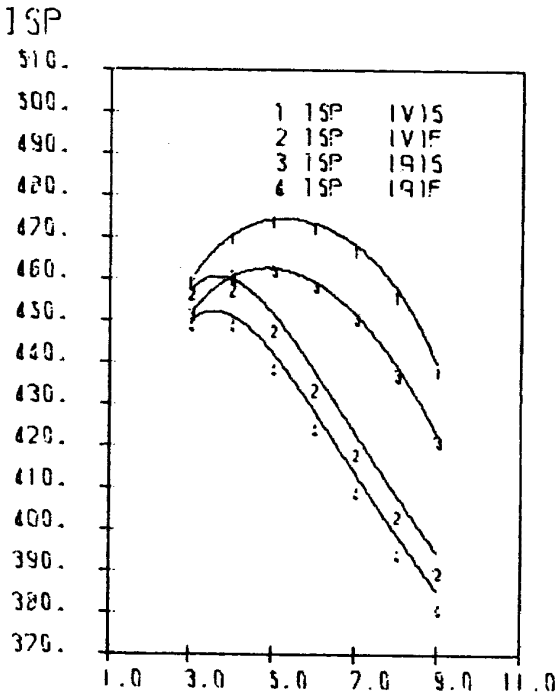
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.3902516E-02	-0.1755195E-02	-0.1064326E-03	0.3205261E-05	-0.2359655E-07
J= 2	-0.2272652E-01	0.5D9085IE-02	-0.5976510E-04	-0.6397327E-06	0.1000854E-07
J= 3	0.7420025E-02	-0.2095901E-02	0.5709054E-04	-0.3664604E-06	-0.3175696E-09
J= 4	0.2419713E-04	0.4499844E-03	-0.1074809E-04	0.9663645E-07	-0.2085601E-09
J= 5	-0.4929365E-04	-0.2225637E-04	0.5807030E-06	-0.5857325E-00	0.1709919E-10

ISP(V) AE/AT=50.		O/F						
EQUILIBRIUM	9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00
80. ATM	422.	439.	451.	457.	459.	457.	448.	427.
60. ATM	421.	438.	450.	456.	459.	457.	448.	427.
40. ATM	420.	437.	449.	456.	459.	457.	448.	427.
10. ATM	416.	432.	446.	454.	458.	457.	448.	427.
FROZEN								
80. ATM	392.	406.	421.	435.	446.	452.	447.	427.
60. ATM	390.	404.	419.	433.	445.	451.	447.	427.
40. ATM	387.	401.	416.	430.	443.	450.	447.	427.
10. ATM	377.	391.	405.	420.	435.	445.	446.	427.

図A 1－2

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2134.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** ISPIVIS ****** III(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.2%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

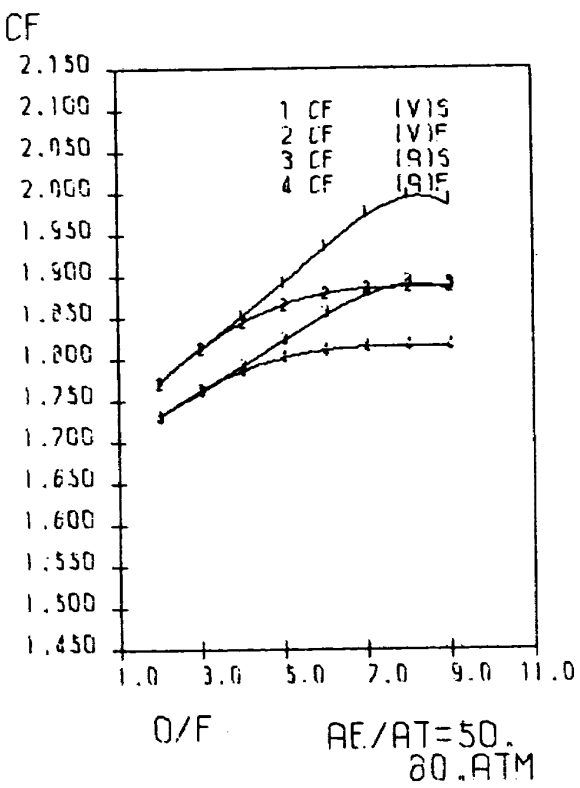
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3388389E 03	0.5978323E 00	-0.3643784E-02	-0.8057142E-05	0.5395729E-07
J= 2	0.5774143E 02	-0.2066769E 00	0.1329201E-02	0.1096213E-04	-0.4012563E-07
J= 3	-0.1113607E 02	0.7595155E-01	-0.6314682E-03	-0.1726383E-05	0.1113202E-07
J= 4	0.7793920E 00	-0.6115159E-02	0.6304544E-04	0.2279357E-06	-0.1341361E-08
J= 5	-0.2127235E-01	0.7529941E-04	-0.1525029E-05	-0.1374200E-07	0.6329305E-10

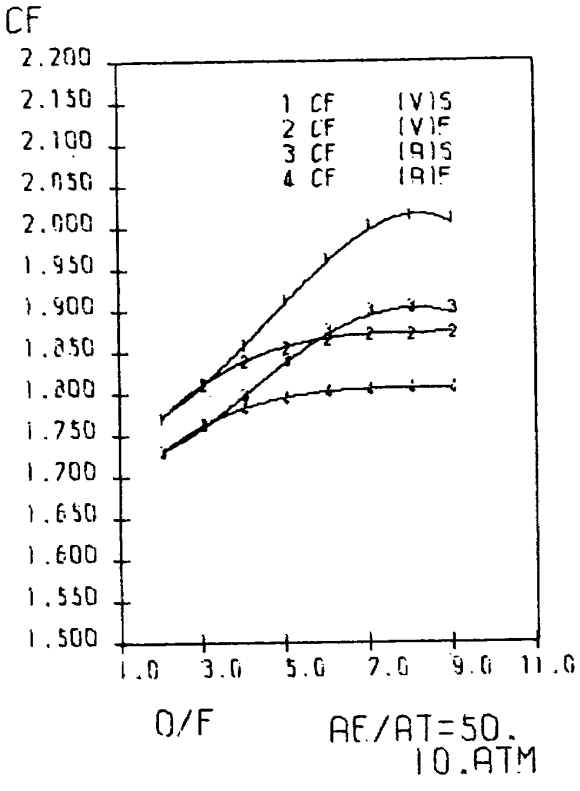
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.2126201E 00	-0.9649653E-02	0.7930537E-04	-0.4008903E-06	0.1356823E-08
J= 2	-0.1108763E 00	0.6465703E-02	-0.4485902E-04	0.2617496E-06	-0.8000816E-09
J= 3	0.8187058E-02	-0.1140015E-02	0.3181083E-05	-0.1651158E-07	0.1022038E-09
J= 4	0.2802621E-02	0.3791802E-04	0.9370927E-06	-0.5770082E-08	0.4150144E-11
J= 5	-0.2731291E-03	0.2537800E-05	-0.9511396E-07	0.5671636E-09	-0.8463216E-12

ISPIVI AE/AT=150.		O/F					
EQUILIBRIUM	9.00	8.00	7.00	6.00	5.00	4.00	3.00
80. ATM	442.	461.	470.	474.	475.	470.	459.
60. ATM	442.	460.	470.	474.	474.	470.	459.
40. ATM	441.	459.	469.	474.	474.	470.	459.
10. ATM	438.	456.	467.	472.	474.	470.	459.
FROZEN							
80. ATM	405.	419.	435.	449.	460.	464.	458.
60. ATM	403.	417.	432.	447.	458.	464.	458.
40. ATM	400.	414.	429.	444.	456.	462.	458.
10. ATM	389.	403.	418.	433.	447.	457.	456.

図A 1－3

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** CF(V)S ****** (((9(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.5%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

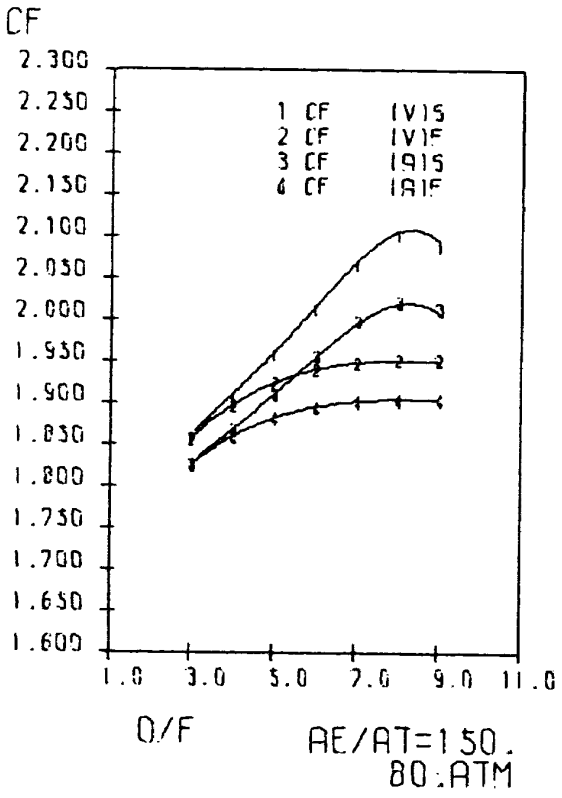
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1664265E 01	0.6048426E-02	-0.1874941E-03	0.2777676E-05	-0.1284132E-07
J= 2	-0.8375024E-01	0.3249812E-02	-0.4436937E-04	-0.1096897E-07	0.1218508E-08
J= 3	0.3135537E-01	-0.7128649E-03	0.8202037E-05	0.2515914E-07	-0.3459696E-09
J= 4	-0.4038109E-02	0.1289445E-03	-0.1777062E-05	0.6616276E-08	-0.1447118E-11
J= 5	0.1734374E-03	-0.7925928E-05	0.1212898E-06	-0.7856137E-09	0.2151843E-11

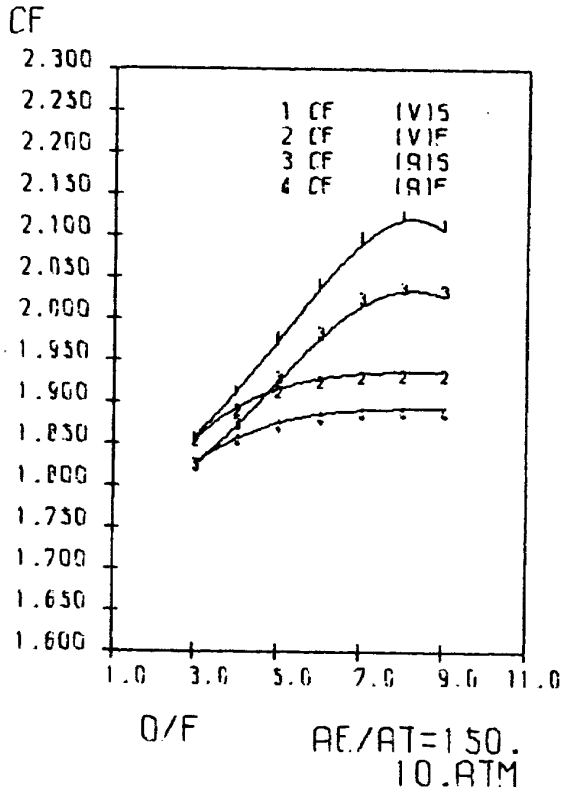
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.1023136E-02	-0.1259952E-04	-0.4376120E-07	0.4617410E-08	-0.6228218E-10
J= 2	0.9317061E-03	0.2646144E-04	-0.4485801E-06	0.2280200E-08	0.2267969E-10
J= 3	-0.2841119E-03	-0.1233426E-04	0.2845470E-06	-0.2673169E-08	0.2839920E-11
J= 4	0.3450935E-04	0.1863628E-05	-0.4896802E-07	0.5231500E-09	-0.1295564E-11
J= 5	-0.1453785E-05	-0.9108608E-07	0.2507927E-08	-0.2937523E-10	0.8895437E-13

CF(V) AE/AT=50.	O/F							
EQUILIBRIUM	9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00
80. ATM	1.992	1.999	1.978	1.937	1.894	1.852	1.813	1.772
60. ATM	1.995	2.002	1.982	1.941	1.897	1.853	1.813	1.772
40. ATM	1.998	2.005	1.987	1.946	1.899	1.854	1.813	1.772
10. ATM	2.011	2.016	2.003	1.964	1.913	1.859	1.813	1.772
FROZEN								
80. ATM	1.887	1.887	1.884	1.878	1.865	1.845	1.812	1.772
60. ATM	1.884	1.884	1.882	1.876	1.865	1.844	1.812	1.772
40. ATM	1.882	1.882	1.880	1.874	1.863	1.843	1.811	1.772
10. ATM	1.872	1.872	1.870	1.866	1.856	1.839	1.811	

図A 1－4

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** CF(V)S ****** ((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.0.7%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1586834E 01	0.5135672E-02	-0.4030120E-05	-0.2621517E-06	0.8415468E-09
J= 2	0.8644302E-01	-0.3121879E-02	0.1339921E-05	0.1921787E-06	-0.6098247E-09
J= 3	-0.1777099E-01	0.9672495E-03	-0.2496077E-05	-0.3972213E-07	0.1497744E-09
J= 4	0.2490352E-02	-0.1024119E-03	0.3430056E-06	0.3946742E-08	-0.1460794E-10
J= 5	-0.1360830E-03	0.3618703E-05	-0.1358715E-07	-0.1520391E-09	0.5718153E-12

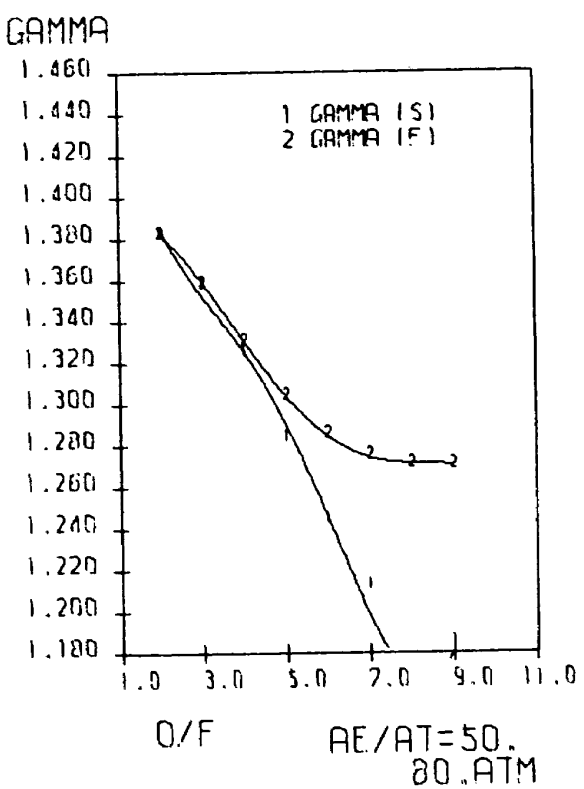
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.1817006E-02	-0.9545292E-04	0.4644013E-06	-0.1160754E-08	0.3510454E-11
J= 2	-0.1119442E-02	0.7144649E-04	-0.3296046E-06	0.7351610E-09	-0.2360233E-11
J= 3	0.1908113E-03	-0.1734881E-04	0.8275793E-07	-0.1995250E-10	0.3451967E-12
J= 4	-0.1169597E-04	0.1640891E-05	-0.2837944E-08	0.1826739E-10	0.7430096E-14
J= 5	0.3600702E-07	-0.5216766E-07	0.0215437E-10	0.1843311E-11	-0.2439116E-14

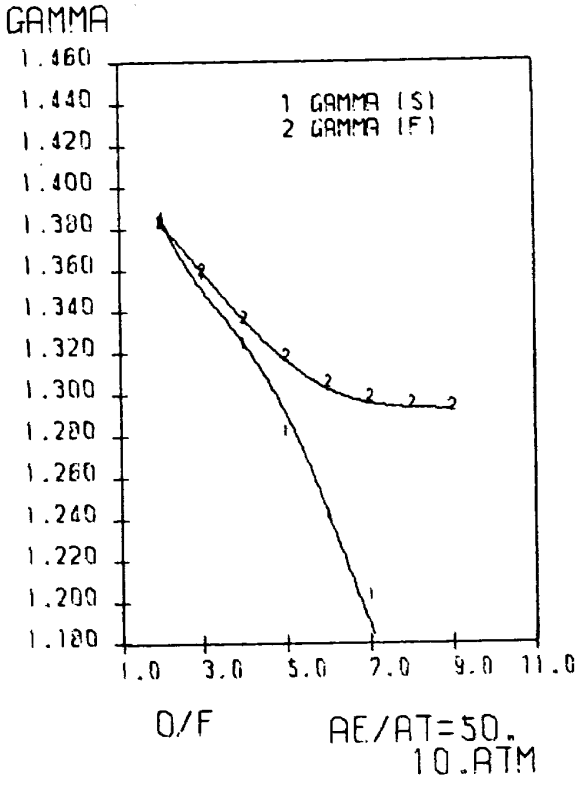
CF(V) AE/AT=150.

EQUILIBRIUM	O/F 9.00	8.00	7.00	6.00	5.00	4.00	3.00
80. ATM	2.087	2.100	2.065	2.011	1.957	1.905	1.856
60. ATM	2.091	2.104	2.070	2.016	1.960	1.905	1.856
40. ATM	2.096	2.109	2.076	2.022	1.962	1.907	1.856
10. ATM	2.115	2.126	2.098	2.043	1.978	1.912	1.856
FROZEN							
80. ATM	1.950	1.950	1.947	1.939	1.922	1.895	1.856
60. ATM	1.947	1.947	1.944	1.936	1.921	1.895	1.855
40. ATM	1.944	1.944	1.941	1.933	1.918	1.893	1.855
10. ATM	1.931	1.931	1.928	1.922	1.910	1.889	1.854

図A 1－5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490





******** GAMMA (S) ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.1.7%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

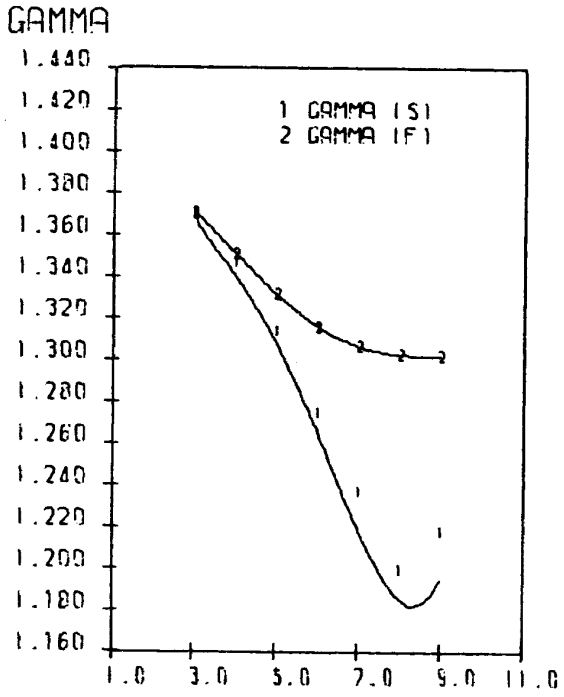
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1571013E 01	-0.4781044E-03	-0.6339750E-04	0.2822909E-05	-0.1450966E-07
J= 2	-0.1030110E 00	0.2710159E-02	-0.6097969E-04	-0.5545787E-06	0.3601952E-08
J= 3	0.4845387E-01	-0.5961810E-03	0.2570753E-04	-0.3672674E-07	-0.4654839E-10
J= 4	-0.7261410E-02	0.6861900E-04	-0.4030569E-05	0.2270437E-07	-0.8297757E-10
J= 5	0.3900810E-03	-0.3858910E-05	0.2271046E-06	-0.1794025E-08	0.7147035E-11

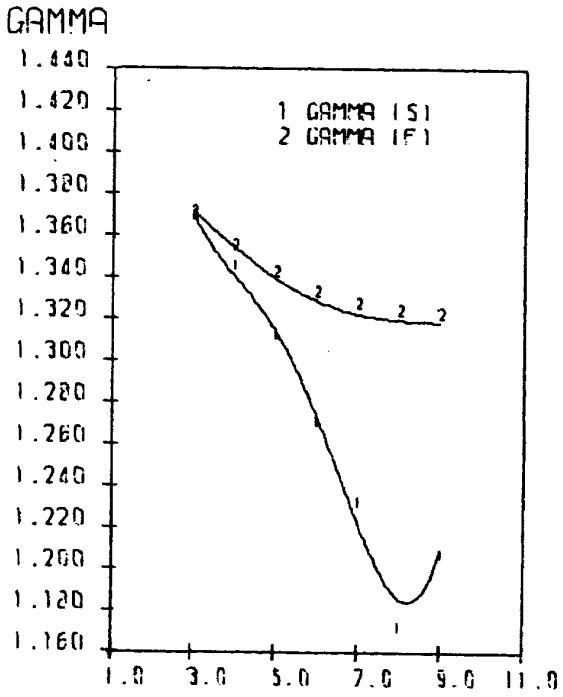
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.5378334E-03	-0.1994091E-04	-0.5892059E-06	0.1477539E-07	-0.1345627E-09
J= 2	-0.5958951E-03	0.3829471E-04	-0.1562590E-06	-0.3636355E-08	0.6847649E-10
J= 3	0.1958575E-03	-0.1709623E-04	0.2874075E-06	-0.2392237E-08	-0.2933422E-11
J= 4	-0.2158077E-04	0.2751077E-05	-0.6097632E-07	0.6939882E-09	-0.1672924E-11
J= 5	0.7257836E-06	-0.1317092E-06	0.3476915E-08	-0.4447999E-10	0.1479395E-12

GAMMA EQUILIBRIUM	AE/AT=50. O/F 9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00
80. ATM	1.187	1.158	1.214	1.246	1.285	1.326	1.359	1.383
60. ATM	1.184	1.154	1.213	1.246	1.285	1.326	1.359	1.383
40. ATM	1.180	1.149	1.212	1.245	1.284	1.326	1.359	1.383
10. ATM	1.160	1.132	1.204	1.243	1.283	1.325	1.359	1.383

図A 1－6

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** GAMMA (S) ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=3.0-9.0, AE/AT=50.-200. (EMAX.LT.2.3%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

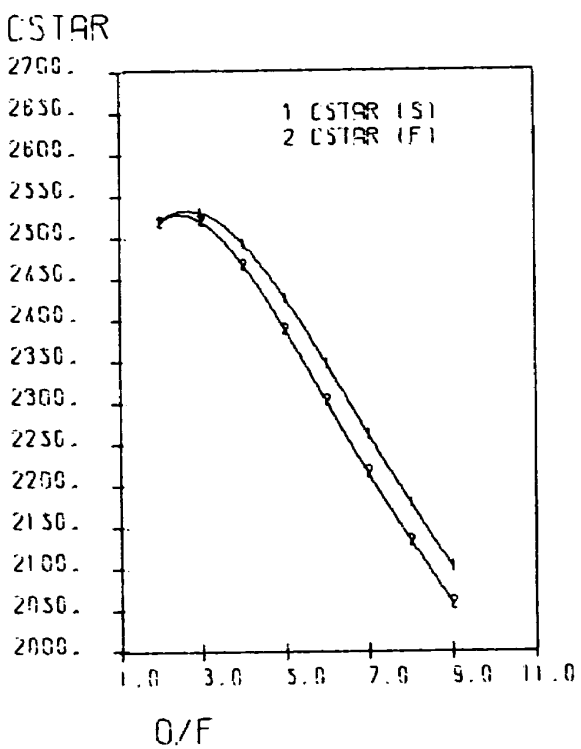
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.2300274E 01	-0.4112493E-02	0.6700183E-04	-0.5049511E-06	0.1030266E-08
J= 2	-0.6084934E 00	0.1488863E-02	-0.3242706E-04	0.2945602E-06	-0.6272122E-09
J= 3	0.1749393E 00	0.2721499E-03	0.1576540E-05	-0.4570133E-07	0.1092338E-09
J= 4	-0.2017868E-01	-0.1071945E-03	0.6461602E-06	0.1338170E-08	-0.5625817E-11
J= 5	0.8434014E-03	0.7416420E-05	-0.5900129E-07	0.9567615E-10	-0.3103462E-13

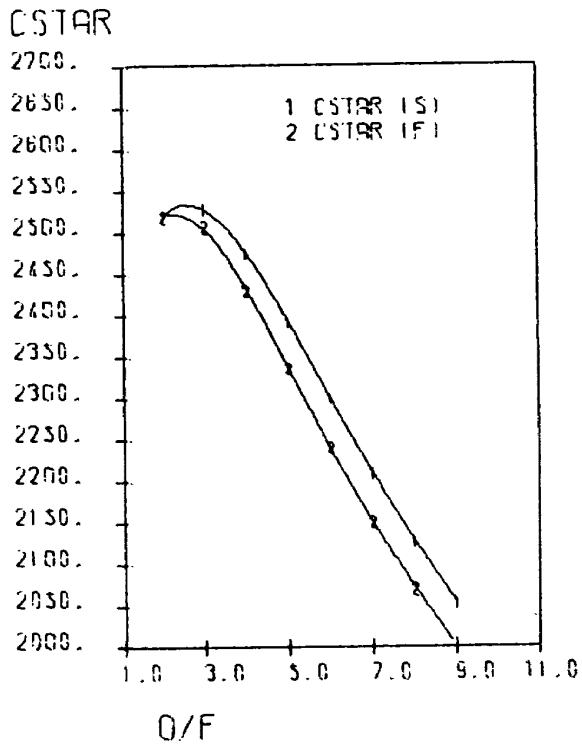
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.7601364E-03	0.2611468E-04	-0.1696474E-05	0.1262516E-07	-0.2410514E-10
J= 2	-0.4953624E-03	0.2804203E-04	0.6716084E-06	-0.6222310E-08	0.1165757E-10
J= 3	0.4586852E-03	-0.2209973E-04	0.6448693E-08	0.6542077E-09	-0.1126032E-11
J= 4	-0.9041744E-04	0.4181225E-05	-0.2199752E-07	0.4100581E-10	-0.9891313E-13
J= 5	0.5205629E-05	-0.2355088E-06	0.1215772E-08	-0.6087013E-11	0.1269914E-13

GAMMA EQUILIBRIUM	AE/AT=150.	O/F					
		9.00	8.00	7.00	6.00	5.00	4.00	3.00
	80. ATM	1.218	1.200	1.237	1.275	1.314	1.347	1.370
	60. ATM	1.217	1.197	1.237	1.275	1.314	1.346	1.370
	40. ATM	1.216	1.193	1.236	1.274	1.314	1.346	1.370
	10. ATM	1.200	1.173	1.232	1.271	1.312	1.346	1.370

図A 1 — 7

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	0.	G	298.15	F	0.0000
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** CSTAR(S) ****** (A(I,J),J=1,5),I=1,3) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0 (EMAX,LT,0.2%)

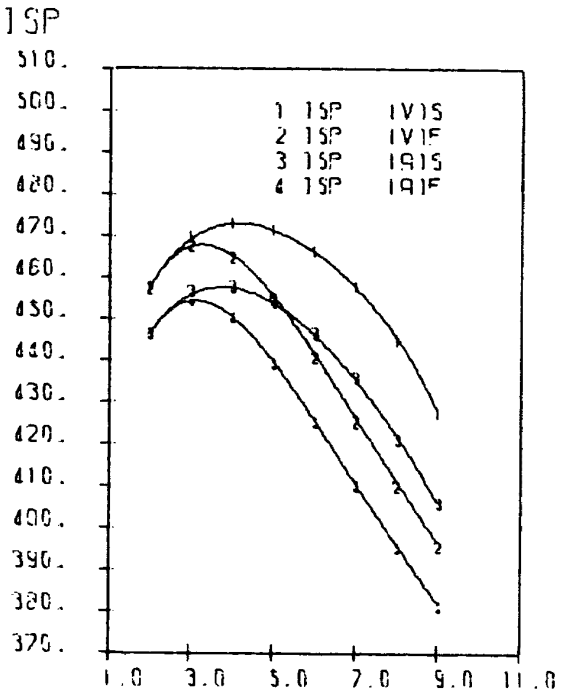
A(I,J) I=(PC)**(I-1)*(O/F)**(J-1)

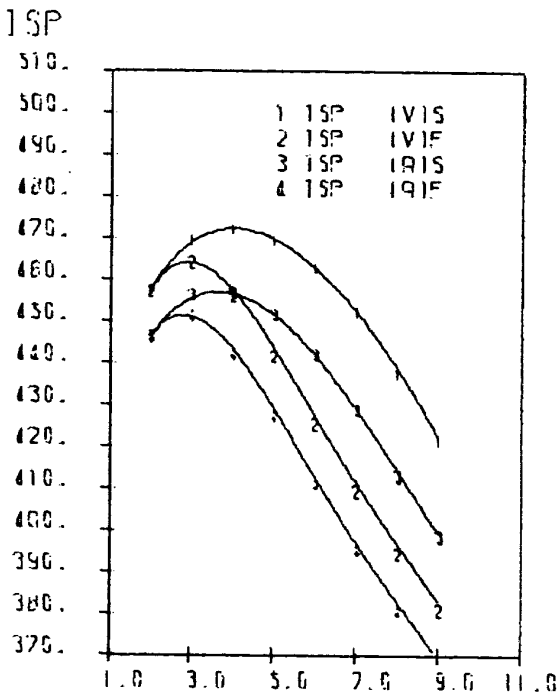
	J=1	J=2	J=3	J=4	J=5
I= 1	0.2156806E 04	0.3425305E 03	-0.1020023E 03	0.1003506E 02	-0.3506544E 00
I= 2	0.2077622E 01	-0.3124311E 01	0.1005596E 01	-0.1330670E 00	0.5462016E-02
I= 3	-0.1719049E-01	0.1919648E-01	-0.6062005E-02	0.8563239E-03	-0.3584108E-04

CSTAR EQUILIBRIUM	O/F 2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
80. ATM	2520.	2530.	2493.	2427.	2340.	2262.	2179.	2102.
60. ATM	2520.	2530.	2491.	2423.	2342.	2255.	2171.	2095.
40. ATM	2520.	2530.	2488.	2417.	2332.	2245.	2161.	2086.
10. ATM	2520.	2528.	2474.	2391.	2299.	2208.	2125.	2052.

図A2－1

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	0.	G	298.15	F	0.0000
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





********* ISP(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.6%)

A(I,J,K)*(PC**(1-I)*(O/F)**(J-1)*(AE/AT)**(K-1))

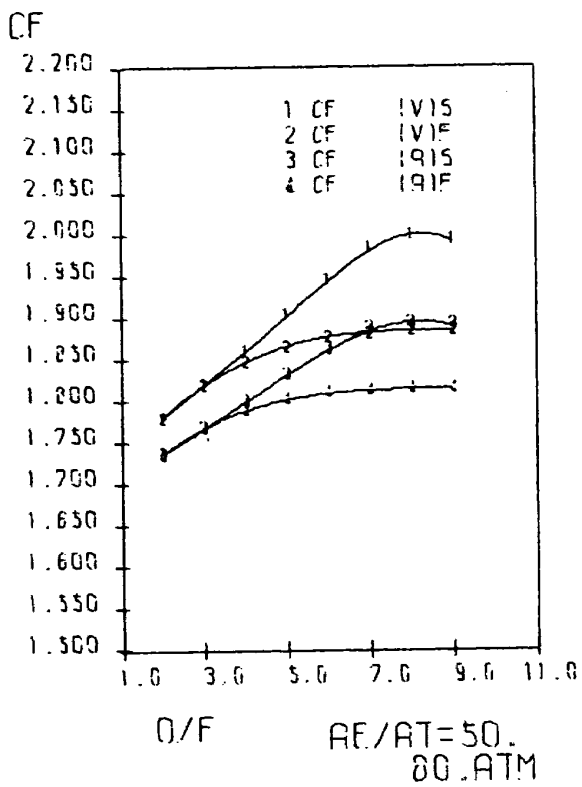
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3679563E 03	0.1295461E 01	-0.4327325E-01	0.4407821E-03	-0.1666079E-05
J= 2	0.3530442E 02	0.3943691E 00	-0.9112101E-02	0.1151762E-03	-0.4967472E-06
J= 3	-0.8006675E 01	0.1432920E-01	-0.4996312E-03	0.6608665E-07	0.1274017E-07
J= 4	0.4652084E 00	-0.1035132E-02	0.1119605E-03	-0.7604106E-06	0.1792530E-08
J= 5	-0.4097665E-02	-0.2665801E-03	-0.6054998E-06	-0.1275792E-08	0.3636124E-10

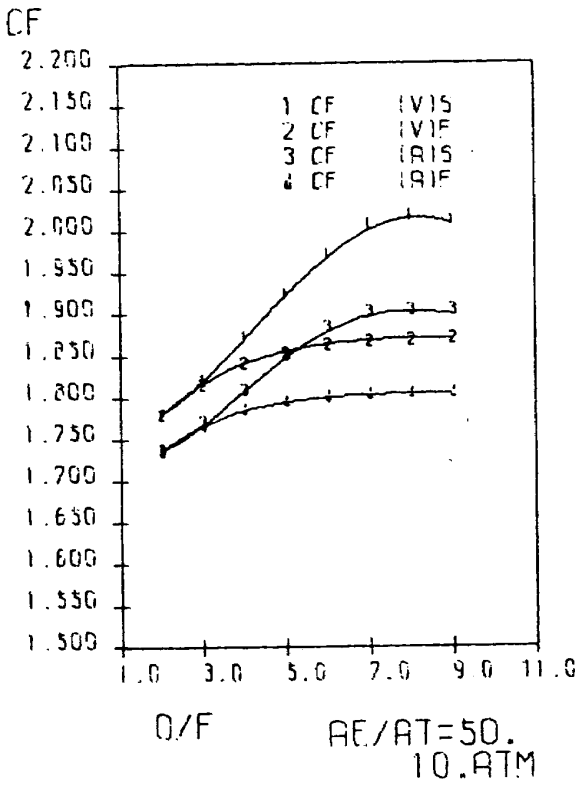
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.3967026E-01	-0.8305030E-03	-0.9464102E-04	0.1381030E-05	-0.6740574E-08
J= 2	-0.4232559E-01	0.2267659E-02	0.4918129E-04	-0.1045311E-05	0.4652134E-08
J= 3	0.1143602E-01	-0.1181650E-02	-0.2270684E-05	0.1784268E-06	-0.8726549E-09
J= 4	-0.2265340E-03	0.1830675E-03	-0.8405979E-06	-0.8849281E-08	0.5426570E-10
J= 5	-0.4071743E-04	-0.8801407E-05	0.6827165E-07	-0.1853159E-10	-0.6587874E-12

ISP(V) AE/AT=50. EQUILIBRIUM		O/F 2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
	80. ATM	457.	470.	473.	471.	466.	458.	445.	428.
	60. ATM	457.	470.	473.	471.	466.	457.	444.	427.
	40. ATM	457.	470.	473.	471.	465.	456.	442.	426.
	10. ATM	457.	470.	472.	470.	463.	452.	437.	421.
FROZEN									
	80. ATM	457.	467.	465.	455.	441.	425.	410.	396.
	60. ATM	457.	467.	464.	453.	439.	423.	408.	394.
	40. ATM	457.	467.	462.	451.	436.	420.	405.	391.
	10. ATM	457.	464.	456.	441.	425.	409.	394.	381.

図A 2－2

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	0.	G	298.15	F	0.0000
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** CF(VIS ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.0.5%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

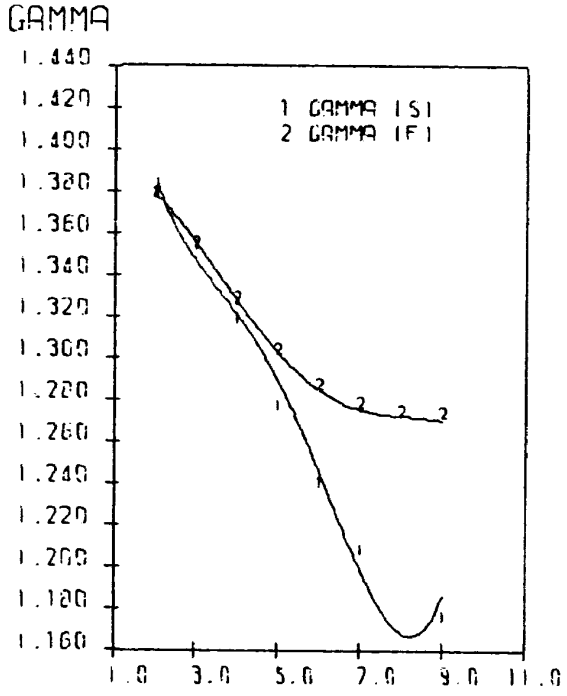
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1659230E 01	0.7784251E-02	-0.1600291E-03	0.1603104E-05	-0.5714692E-08
J= 2	-0.2648593E-01	0.1130710E-02	-0.3242251E-04	0.4962534E-06	-0.2354278E-08
J= 3	0.2990212E-01	0.1082502E-03	-0.2337348E-05	-0.1345417E-07	0.1638237E-09
J= 4	-0.3994573E-02	0.1136752E-04	0.1151089E-06	0.1792764E-08	-0.1691202E-10
J= 5	0.1770246E-03	-0.2350515E-05	0.2104660E-07	-0.2906212E-09	0.1394897E-11

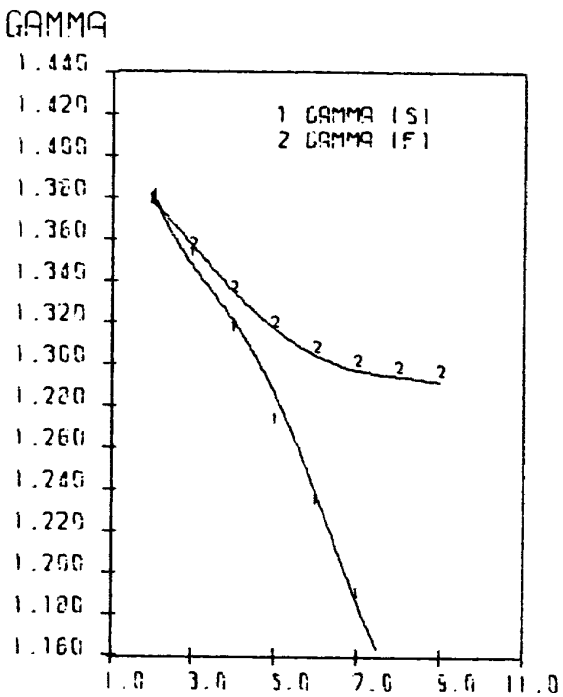
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.8278392E-03	-0.4417603E-05	-0.4871783E-06	0.8804970E-08	-0.4106093E-10
J= 2	0.2310700E-03	0.1359980E-04	0.1705433E-06	-0.4759852E-08	0.2392401E-10
J= 3	-0.2001148E-03	-0.7053943E-05	0.3575266E-07	0.3708249E-09	-0.2702742E-11
J= 4	0.3712176E-04	0.1075811E-05	-0.1204424E-07	-0.5390401E-10	0.9821423E-13
J= 5	-0.1686717E-05	-0.5177623E-07	0.7606545E-09	-0.5703015E-11	0.1951623E-13

CF(V) AE/AT=50.		O/F						
EQUILIBRIUM	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
80. ATM	1.780	1.820	1.861	1.904	1.947	1.985	2.001	1.995
60. ATM	1.780	1.820	1.862	1.907	1.950	1.988	2.004	1.998
40. ATM	1.780	1.820	1.864	1.910	1.956	1.992	2.008	2.001
10. ATM	1.780	1.821	1.872	1.926	1.974	2.000	2.018	2.014
FROZEN								
80. ATM	1.780	1.818	1.847	1.866	1.876	1.882	1.885	1.885
60. ATM	1.780	1.817	1.846	1.864	1.874	1.880	1.882	1.882
40. ATM	1.780	1.818	1.845	1.862	1.872	1.877	1.879	1.880
10. ATM	1.780	1.816	1.840	1.854	1.862	1.867	1.869	1.870

図A 2－3

CHEMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	0.	G	298.15	F	0.0000
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





******** GAMMA (S) ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=2.0-9.0, AE/AT=10.-100. (EMAX.LT.14.%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

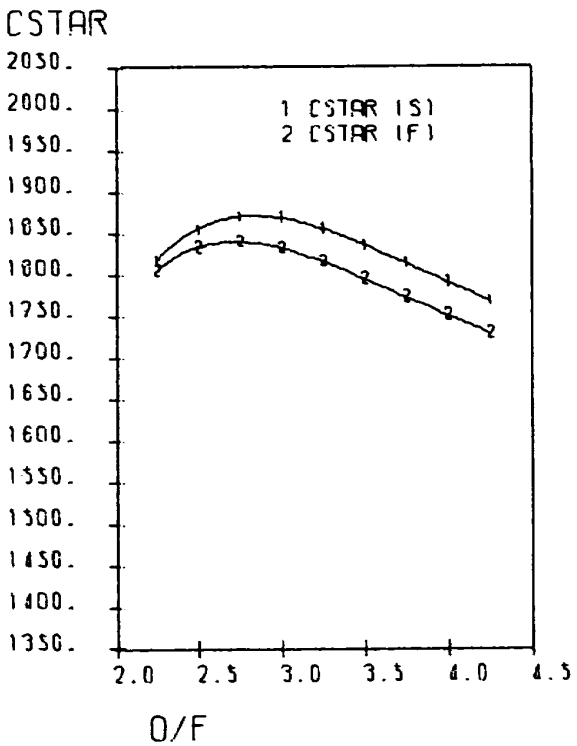
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1650452E 01	-0.1287414E-01	0.3924692E-03	-0.3019759E-05	0.1611016E-08
J= 2	-0.2363635E 00	0.1098201E-01	-0.3420227E-03	0.2723717E-05	-0.1967543E-08
J= 3	0.5787198E-01	-0.2295883E-02	0.7706264E-04	-0.5357791E-06	0.4406341E-09
J= 4	-0.7759611E-02	0.1901811E-03	-0.6065116E-05	0.3179950E-07	-0.1959921E-09
J= 5	0.3892974E-03	-0.5831267E-05	0.2137355E-06	-0.2006720E-09	-0.1366907E-10

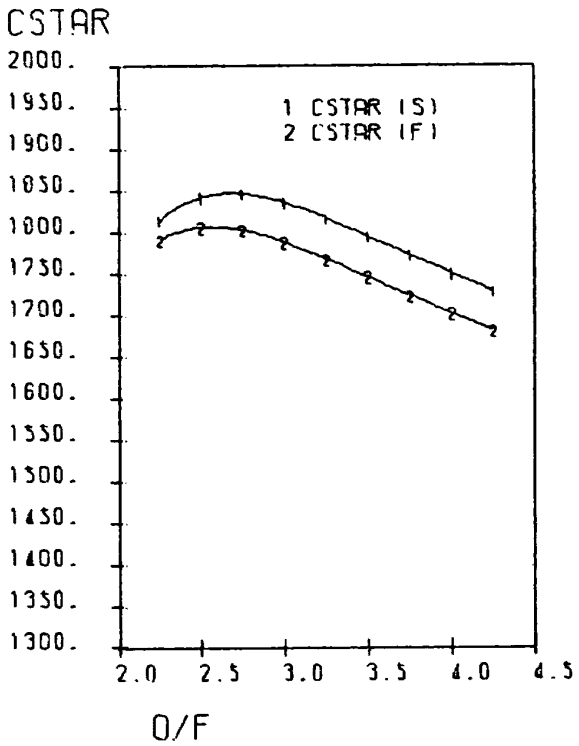
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.1509772E-03	0.1857060E-03	-0.1337904E-04	0.3091783E-06	-0.2241837E-08
J= 2	-0.8063499E-03	-0.1435654E-04	0.5301230E-05	-0.1625799E-06	0.1340962E-08
J= 3	0.5096048E-03	-0.3334060E-04	0.1241664E-06	0.2203327E-07	-0.2620848E-09
J= 4	-0.8354623E-04	0.7086332E-05	-0.1601410E-06	-0.2583122E-09	0.1860992E-10
J= 5	0.4262629E-05	-0.4726553E-06	0.1259699E-07	-0.7033605E-10	-0.3356379E-12

GAMMA, EQUILIBRIUM	AE/AT=50.	O/F					
	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
80. ATM	1.379	1.354	1.319	1.277	1.240	1.208	1.182	1.176
60. ATM	1.379	1.354	1.319	1.277	1.240	1.207	1.185	1.173
40. ATM	1.379	1.354	1.319	1.276	1.239	1.204	1.180	1.160
10. ATM	1.379	1.354	1.318	1.274	1.236	1.191	1.124	1.146

図A 2－4

CHEMICAL FORMULA	WT PERCENT	ENERGY STATE	TEMP		DENSITY
		CAL/MOL	DEG K		G/CC
C 1.0 H 4.0	100.	-21390.0	L 111.66	F	0.4239
O 2.0	100.	-3102.0	L 90.18	O	1.1490





******** CSTAR(S) ****** ((A(I,J),J=1,5),I=1,3) **********

PC=80.ATM-10.ATM, O/F=2.25-4.25 (EMAX.LT.0.2%)

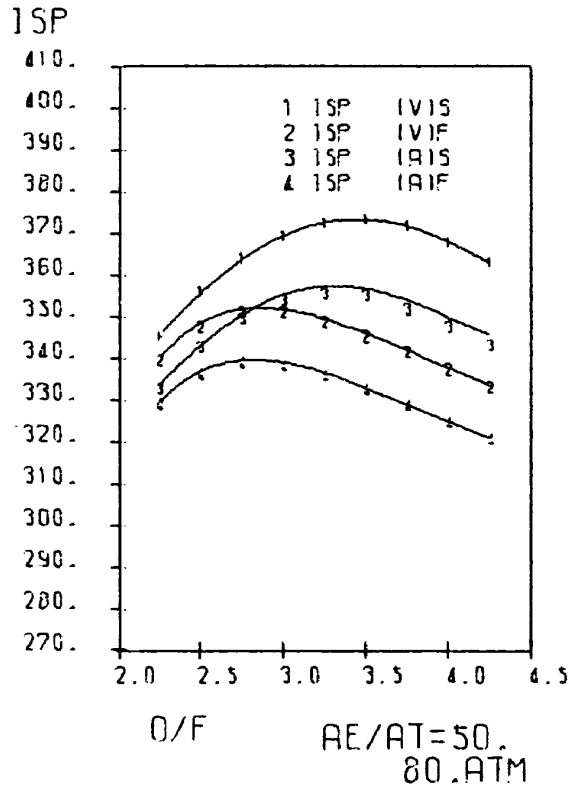
A(I,J)*(PC)**(I-1)*(O/F)**(J-1)

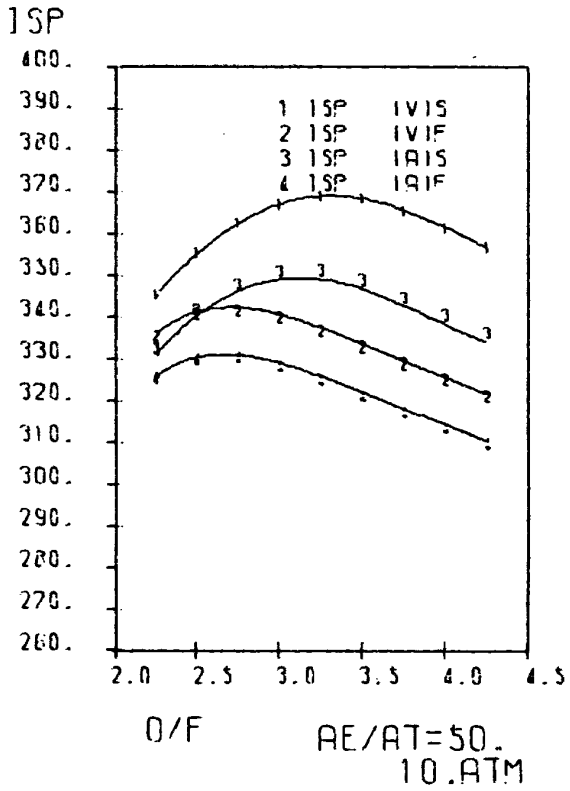
	J=1	J=2	J=3	J=4	J=5
I= 1	-0.2321179E 04	0.4870673E 04	-0.2057040E 04	0.3775274E 03	-0.2586589E 02
I= 2	0.3027147E 02	-0.4417042E 02	0.2297089E 02	-0.5009202E 01	0.3936429E 00
I= 3	-0.2418968E 00	0.3480564E 00	-0.1798236E 00	0.3926047E-01	-0.3100376E-02

CSTAR EQUILIBRIUM	O/F 2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25
80. ATM	1818.	1855.	1871.	1870.	1856.	1836.	1815.	1792.	1769.
60. ATM	1818.	1853.	1868.	1865.	1851.	1831.	1808.	1786.	1764.
40. ATM	1817.	1851.	1864.	1859.	1843.	1822.	1800.	1778.	1755.
10. ATM	1813.	1840.	1845.	1834.	1815.	1793.	1771.	1748.	1727.

図A 3－1

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
C 1.0 H 4.0	100.	-21390.0	L	111.66	F	0.4239
O 2.0	100.	-3102.0	L	90.18	O	1.1490





******** ISPIVIS ****** I(IA(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=2.25-4.25, AE/AT=10.-75. (EMAX.LT.0.7%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1133033E 03	0.3865405E 01	-0.2331904E-01	0.8833363E-03	-0.9296431E-05
J= 2	0.8939734E 02	-0.1903949E 01	-0.5897712E-01	0.2499023E-03	0.4174341E-05
J= 3	0.2295583E 02	0.9230765E 00	0.2330012E-01	-0.7751422E-04	-0.2083197E-05
J= 4	-0.1649020E 02	-0.5429615E-01	-0.6703133E-02	0.3639427E-04	0.3485021E-06
J= 5	0.1967911E 01	-0.1207024E-01	0.7063910E-03	-0.5354086E-05	-0.1753293E-07

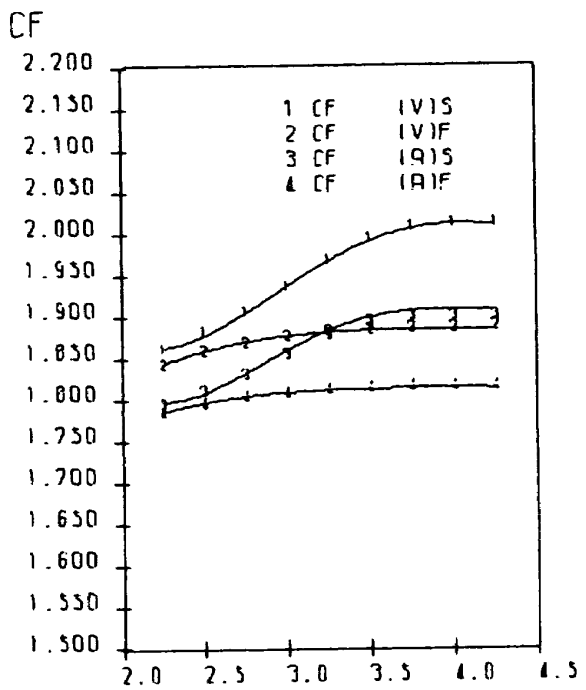
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.7721834E 00	0.4922002E-01	-0.1332116E-02	0.1901943E-05	0.1246368E-07
J= 2	-0.9759437E 00	-0.5722415E-01	0.1747701E-02	-0.4602908E-05	-0.1116375E-08
J= 3	0.4295189E 00	0.2118418E-01	-0.6764101E-03	-0.1216427E-07	0.1371900E-07
J= 4	-0.7416304E-01	-0.2828560E-02	0.8462431E-04	0.9494216E-06	-0.8757614E-08
J= 5	0.4249290E-02	0.8559204E-04	-0.1018600E-05	-0.1712900E-06	0.1295431E-08

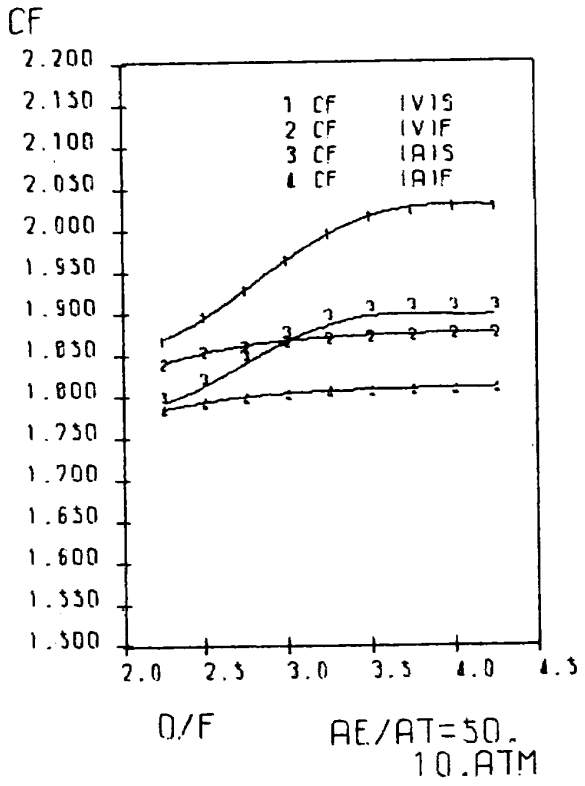
ISP(V) AE/AT=50. O/F

EQUILIBRIUM	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25
80. ATM	346.	356.	364.	369.	373.	373.	372.	368.	363.
60. ATM	346.	356.	364.	369.	372.	373.	371.	367.	362.
40. ATM	346.	356.	364.	369.	372.	372.	370.	366.	361.
10. ATM	345.	356.	363.	367.	369.	369.	366.	361.	357.
FROZEN									
80. ATM	339.	348.	351.	351.	349.	345.	341.	337.	333.
60. ATM	339.	347.	350.	350.	347.	344.	340.	336.	332.
40. ATM	338.	346.	348.	347.	345.	341.	337.	333.	329.
10. ATM	336.	341.	342.	340.	337.	333.	329.	325.	321.

図A 3－2

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
C 1.0 H 4.0	100.	-21390.0	L	111.66	F	0.4239
O 2.0	100.	-3102.0	L	90.18	O	1.1490





********* CF(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-20.ATM, O/F=2.25-4.25, AE/AT=10.-75. (EMAX.LT.0.9%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

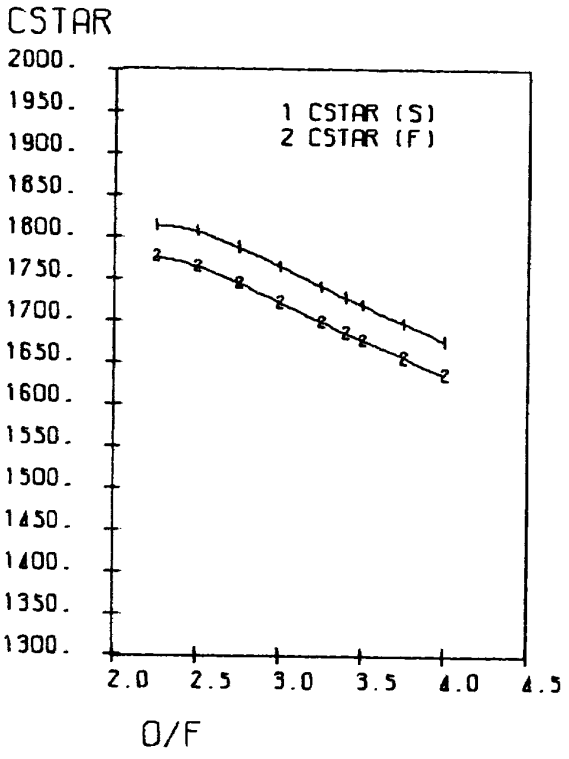
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3900342E 01	0.3091743E-01	0.3889366E-03	-0.1139360E-04	0.6029398E-07
J= 2	-0.3139673E 01	-0.3234340E-01	-0.3870950E-03	0.1013359E-04	-0.4249270E-07
J= 3	0.1554174E 01	0.1933931E-01	-0.9957542E-04	0.6844140E-06	-0.1433330E-07
J= 4	-0.3312127E 00	-0.4013802E-02	0.3941226E-04	-0.1035626E-05	0.8972020E-08
J= 5	0.2576539E-01	0.2768136E-03	-0.6655341E-05	0.1365603E-06	-0.1091730E-08

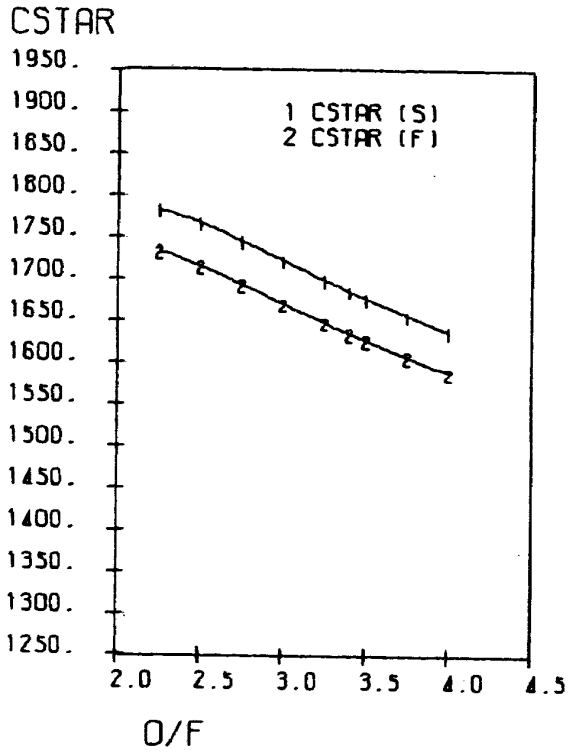
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.4149767E-02	0.1558772E-03	0.6625727E-06	-0.1718019E-06	0.1358295E-08
J= 2	0.7038855E-02	-0.2696599E-03	0.4066317E-05	0.1240394E-06	-0.1161427E-08
J= 3	-0.4945504E-02	0.1579617E-03	-0.3950571E-05	-0.2026131E-07	0.3168244E-09
J= 4	0.1263264E-02	-0.3963823E-04	0.1209976E-05	-0.3012841E-08	-0.2348694E-10
J= 5	-0.1133956E-03	0.3602823E-05	-0.1207210E-06	0.7261926E-09	-0.1020041E-11

CF(V) AE/AT=50.	O/F								
EQUILIBRIUM	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25
80. ATM	1.864	1.883	1.900	1.937	1.968	1.994	2.008	2.013	2.012
60. ATM	1.864	1.885	1.910	1.941	1.971	1.997	2.012	2.015	2.014
40. ATM	1.865	1.886	1.913	1.945	1.977	2.002	2.015	2.017	2.018
10. ATM	1.868	1.895	1.928	1.964	1.994	2.016	2.024	2.027	2.026
FROZEN									
80. ATM	1.842	1.858	1.870	1.878	1.882	1.885	1.887	1.887	1.888
60. ATM	1.842	1.857	1.868	1.876	1.881	1.883	1.885	1.886	1.887
40. ATM	1.841	1.856	1.866	1.874	1.878	1.880	1.882	1.883	1.884
10. ATM	1.839	1.852	1.860	1.865	1.870	1.871	1.874	1.874	1.875

図A 3－3

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
C 1.0 H 1.9423	100.	-5430.0	L	298.15	F	0.7730
O 2.0	100.	-3102.0	L	90.18	O	1.1490





******** CSTAR(S) ****** ((A(I,J),J=1,5),I=1,3) **********

PC=80.ATM-10.ATM, O/F=2.25-4.00 (EMAX.LT.0.2%)

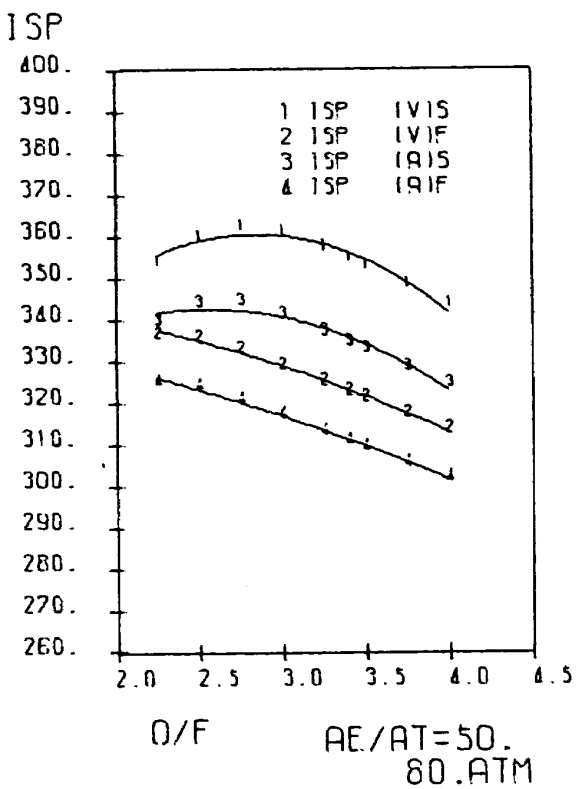
A(I,J)*(PC)**(I-1)*(O/F)**(J-1)

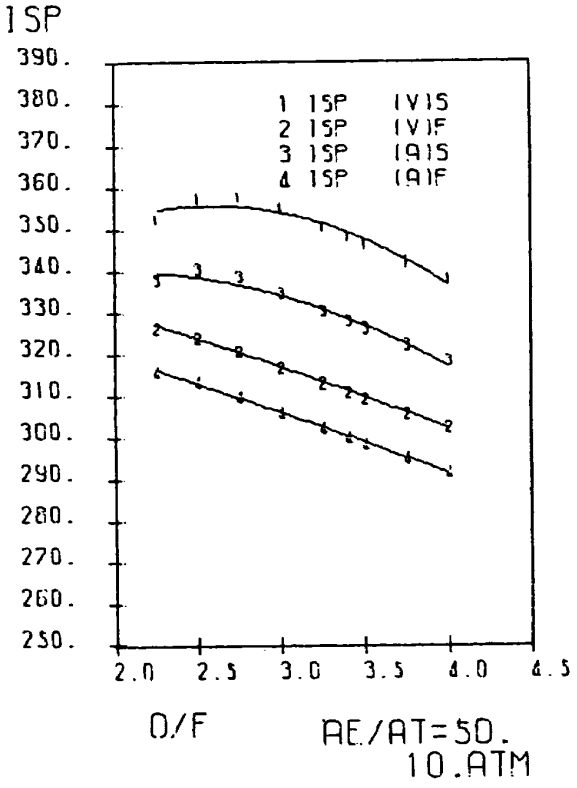
	J=1	J=2	J=3	J=4	J=5
I= 1	0.1476159E 04	0.4617512E 03	-0.2349300E 03	0.4072620E 02	-0.2447961E 01
I= 2	-0.5764909E 02	0.7413428E 02	-0.3465633E 02	0.7153631E 01	-0.5505282E 00
I= 3	0.4400490E 00	-0.5723002E 00	0.2711659E 00	-0.5662058E-01	0.4398965E-02

CSTAR EQUILIBRIUM	O/F 2.25	2.50	2.75	3.00	3.25	3.40	3.50	3.75	4.00
80. ATM	1814.	1807.	1788.	1765.	1741.	1728.	1719.	1697.	1676.
60. ATM	1810.	1801.	1782.	1759.	1735.	1722.	1713.	1691.	1670.
40. ATM	1804.	1793.	1773.	1750.	1726.	1713.	1704.	1683.	1662.
10. ATM	1780.	1764.	1742.	1719.	1696.	1683.	1674.	1653.	1634.

図A 4－1

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
C 1.0 H 1.9423	100.	-5430.0	L	298.15	F	0.7730
O 2.0	100.	-3102.0	L	90.18	O	1.1490





******** ISP(VIS ****** ((A(I,J,K),K=1,5),J=1,3),I=1,3) **********

PC=80.ATM-10.ATM, O/F=2.25-4.00, AE/AT=10.-100. (EMAX.LT.0.9%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3748735E 03	-0.5548613E 01	0.1621721E 00	-0.2046400E-02	0.8814337E-05
J= 2	-0.4366451E 02	0.5733244E 01	-0.1518953E 00	0.1811825E-02	-0.7569969E-05
J= 3	0.4579233E 01	-0.8919342E 00	0.2381893E-01	-0.2842697E-03	0.1187237E-05

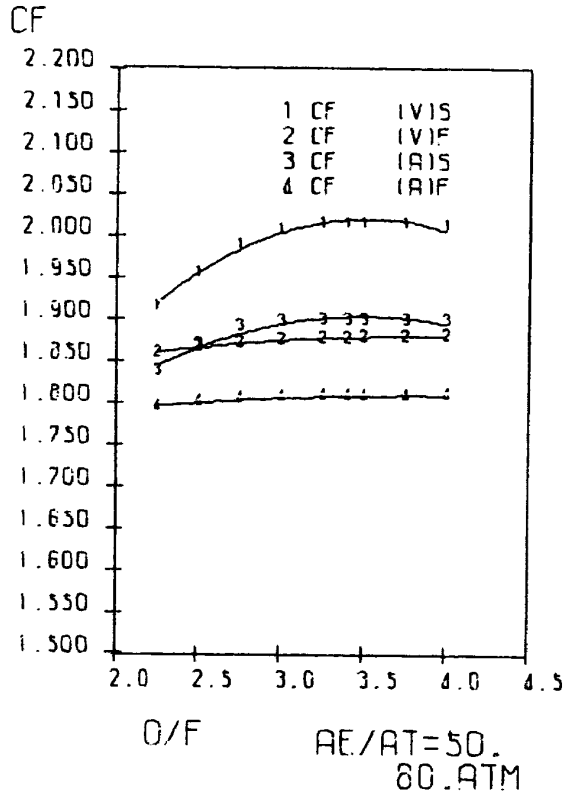
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.7814290E 00	-0.3255235E-01	0.1594112E-02	-0.2801195E-04	0.1503921E-06
J= 2	0.5966733E 00	0.2145752E-01	-0.1112344E-02	0.1956001E-04	-0.1045533E-06
J= 3	-0.8771907E-01	-0.3479516E-02	0.1864060E-03	-0.3273942E-05	0.1743319E-07

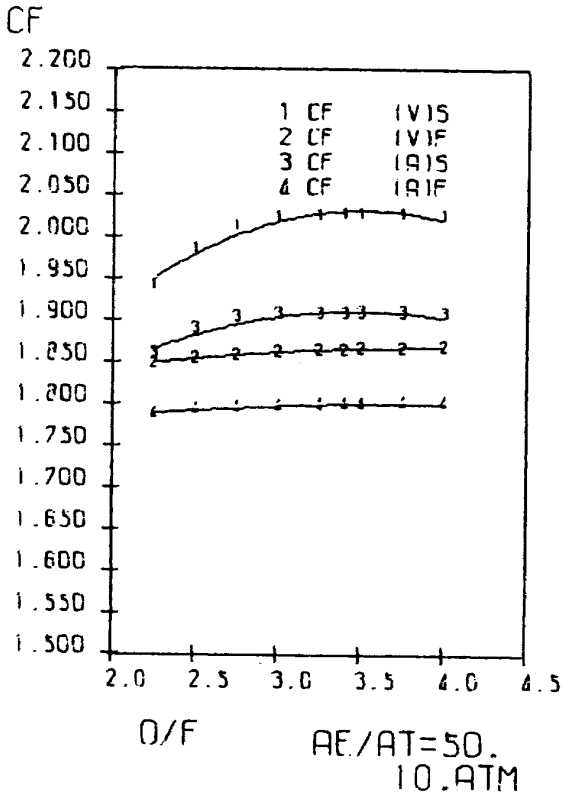
I=3	K=1	K=2	K=3	K=4	K=5
J= 1	-0.5048293E-02	0.1574006E-02	-0.6445334E-04	0.9649507E-06	-0.4664613E-08
J= 2	0.2862911E-02	-0.1049469E-02	0.4331613E-04	-0.6489045E-06	0.3135251E-08
J= 3	-0.5120925E-03	0.1695045E-03	-0.7032058E-05	0.1053778E-06	-0.5089190E-09

ISP(V) AE/AT=50.				O/F					
EQUILIBRIUM	2.25	2.50	2.75	3.00	3.25	3.40	3.50	3.75	4.00
80. ATM	355.	361.	363.	362.	358.	355.	354.	349.	344.
60. ATM	354.	360.	362.	361.	357.	354.	353.	348.	344.
40. ATM	354.	360.	361.	360.	356.	353.	351.	347.	342.
10. ATM	353.	357.	358.	355.	351.	348.	346.	342.	338.
FROZEN									
80. ATM	337.	336.	333.	330.	326.	323.	322.	318.	314.
60. ATM	336.	335.	332.	328.	324.	321.	320.	316.	312.
40. ATM	334.	332.	329.	325.	321.	319.	317.	314.	310.
10. ATM	326.	324.	321.	317.	313.	311.	309.	306.	302.

図A 4－2

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
C 1.0 H 1.9423	100.	-5430.0	L	298.15	F	0.7730
O 2.0	100.	-3102.0	L	90.18	O	1.1490





******** CF(V)S ****** ((A(I,J,K),K=1,5),J=1,3),I=1,3) **********

PC=80.ATM-10.ATM, O/F=2.25-4.00, AE/AT=10.-100. (EMAX.LT.0.6%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1862614E 01	-0.3133067E-01	0.8790600E-03	-0.1087235E-04	0.4628031E-07
J= 2	-0.1415410E 00	0.3168594E-01	-0.8195915E-03	0.9642650E-05	-0.3993440E-07
J= 3	0.2220224E-01	-0.4775198E-02	0.1252636E-03	-0.1479350E-05	0.6134815E-08

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.2016893E-02	-0.1633455E-03	0.8938450E-05	-0.1601286E-06	0.8633980E-09
J= 2	0.1564300E-02	0.9871736E-04	-0.6004657E-05	0.1089959E-06	-0.5883574E-09
J= 3	-0.2168285E-03	-0.1622644E-04	0.1006783E-05	-0.1820333E-07	0.9702516E-10

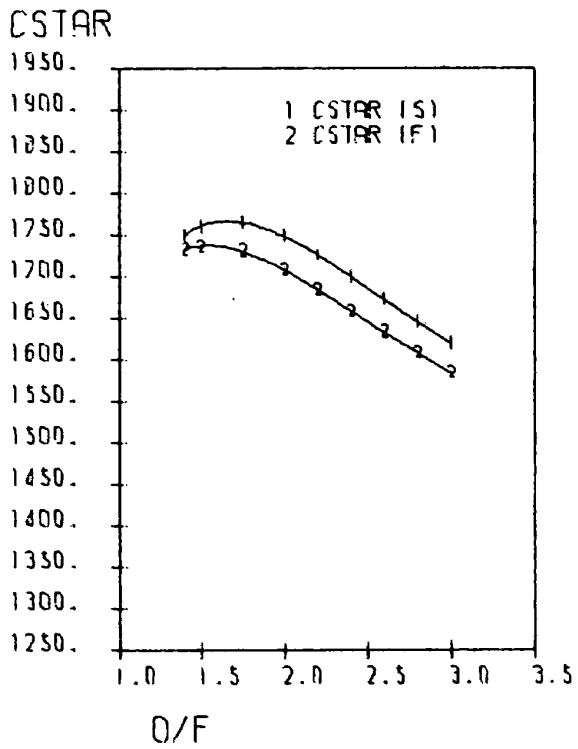
I=3	K=1	K=2	K=3	K=4	K=5
J= 1	-0.3266271E-04	0.8323173E-05	-0.3469314E-06	0.5229273E-08	-0.2536763E-10
J= 2	0.2380526E-04	-0.5489407E-05	0.2316439E-06	-0.3498928E-08	0.1697695E-10
J= 3	-0.4073170E-05	0.8874007E-06	-0.3759713E-07	0.5679110E-09	-0.2753989E-11

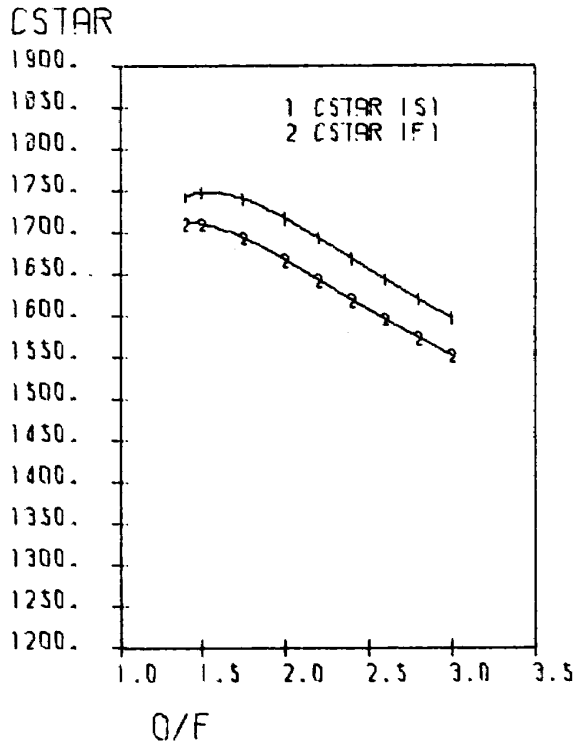
CF(V) AE/AT=50.

EQUILIBRIUM	O/F 2.25	2.50	2.75	3.00	3.25	3.40	3.50	3.75	4.00
80. ATM	1.917	1.957	1.990	2.010	2.017	2.016	2.017	2.016	2.015
60. ATM	1.920	1.961	1.994	2.012	2.018	2.018	2.018	2.018	2.017
40. ATM	1.924	1.967	1.999	2.015	2.020	2.021	2.021	2.020	2.019
10. ATM	1.943	1.986	2.014	2.025	2.028	2.028	2.029	2.029	2.027
FROZEN									
80. ATM	1.860	1.869	1.873	1.877	1.879	1.880	1.881	1.881	1.882
60. ATM	1.859	1.867	1.872	1.874	1.877	1.878	1.879	1.879	1.881
40. ATM	1.857	1.865	1.870	1.872	1.874	1.876	1.876	1.876	1.878
10. ATM	1.849	1.855	1.860	1.863	1.865	1.866	1.867	1.868	1.869

図A 4 — 3

CHEMICAL FORMULA	WT PERCENT	ENERGY STATE	TEMP DEG K		DENSITY G/CC
		CAL/MOL			
N 2.0 H 8.0 C 2.0	50.	11900.0	L 298.15	F	0.783
N 2.0 H 4.0	50.	12100.0	L 298.15	F	1.0036
N 2.0 O 4.0	100.	-4680.0	L 298.15	O	1.431





******** CSTAR(S) ****** (A(I,J),J=1,5),I=1,3) **********

PC=80.ATM-10.ATM, O/F=1.4-3.0 (EMAX.LT.0.2%)

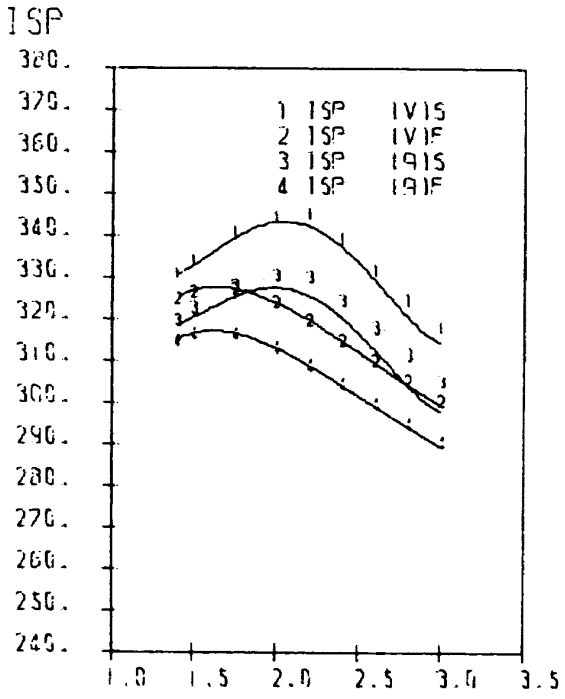
A(I,J) *(PC)**(I-1)*(O/F)**(J-1)

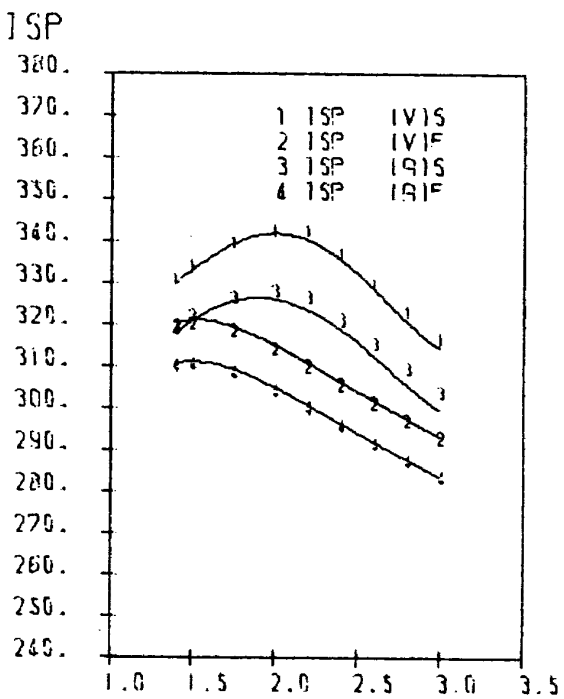
	J=1	J=2	J=3	J=4	J=5
I= 1	0.6708811E 03	0.1945709E 04	-0.1237717E 04	0.3257275E 03	-0.3177409E 02
I= 2	-0.1122955E 02	0.1641363E 02	-0.7772760E 01	0.1313569E 01	-0.1000577E 00
I= 3	0.1196775E 00	-0.1986506E 00	0.1157972E 00	-0.2969499E-01	0.2843502E-02

CSTAR EQUILIBRIUM	O/F 1.40	1.50	1.75	2.00	2.20	2.40	2.60	2.80	3.00
80. ATM	1751.	1760.	1766.	1750.	1727.	1700.	1673.	1646.	1620.
60. ATM	1751.	1759.	1763.	1746.	1722.	1696.	1669.	1643.	1618.
40. ATM	1749.	1757.	1759.	1739.	1716.	1690.	1664.	1638.	1613.
10. ATM	1743.	1747.	1740.	1716.	1693.	1668.	1643.	1619.	1596.

図A 5－1

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
N 2.0 H 2.0 C 2.0	50.	11900.0	L	298.15	F	0.703
N 2.0 H 4.0	50.	12100.0	L	298.15	F	1.0036
N 2.0 O 4.0	100.	-4680.0	L	298.15	O	1.431





******** ISP(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=1.4-3.0, AE/AT=10.-100. (EMAX.LT.1.6%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.4261912E 03	-0.2370607E-01	0.6015754E-02	0.6402564E-03	-0.3770449E-05
J= 2	-0.3336281E 03	0.1221534E 01	-0.5450202E-01	-0.5606073E-03	0.3883932E-05
J= 3	0.2860491E 03	0.1003533E 01	0.7713119E-02	0.5745481E-03	-0.2824101E-05
J= 4	-0.1028434E 03	-0.5321303E 00	-0.1083683E-03	-0.1555440E-03	0.6131738E-06
J= 5	0.1206556E 02	0.5463211E-01	0.4042485E-03	0.8978399E-05	-0.1707702E-07

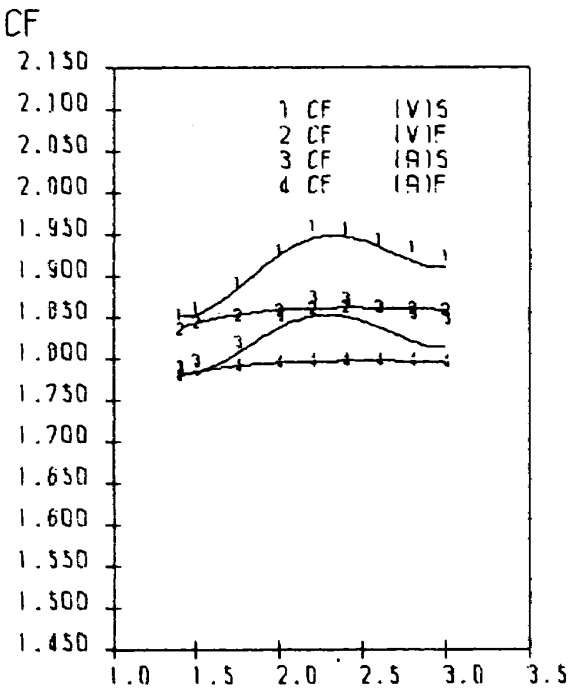
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.3266474E 01	0.1014961E 00	0.4719402E-03	-0.3616008E-04	0.1643527E-06
J= 2	0.6061121E 01	-0.3525456E 00	-0.4415103E-03	0.5952420E-04	-0.2572458E-06
J= 3	-0.4136471E 01	0.2507001E 00	-0.3000756E-04	-0.3455712E-04	0.1381320E-06
J= 4	0.1247965E 01	-0.7790109E-01	0.1230382E-03	0.8241346E-05	-0.2088559E-07
J= 5	-0.1405080E 00	0.8919513E-02	-0.2684576E-04	-0.6671424E-06	0.1700416E-08

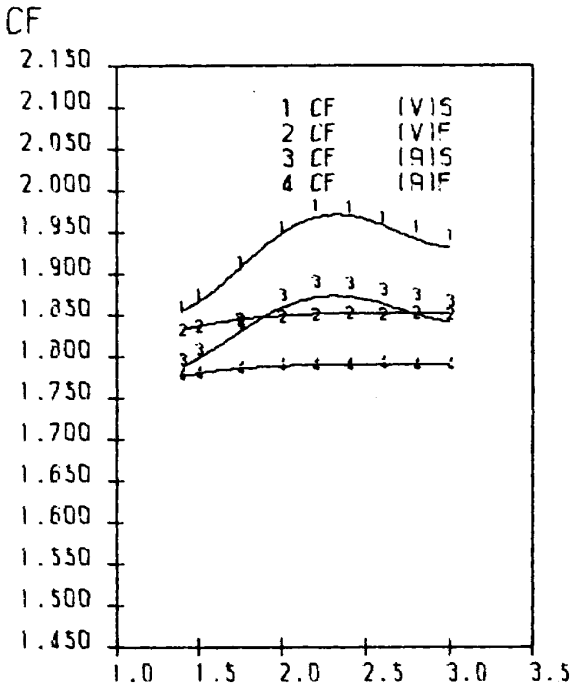
ISP(V) AE/AT=50.

EQUILIBRIUM	O/F 1.40	1.50	1.75	2.00	2.20	2.40	2.60	2.80	3.00
80. ATM	331.	335.	341.	345.	345.	339.	332.	325.	318.
60. ATM	331.	335.	341.	344.	345.	339.	332.	325.	318.
40. ATM	331.	334.	341.	344.	344.	339.	331.	324.	318.
10. ATM	331.	334.	340.	343.	343.	337.	330.	323.	317.
FROZEN									
80. ATM	325.	327.	327.	324.	320.	315.	310.	305.	301.
60. ATM	324.	326.	326.	323.	319.	314.	309.	304.	300.
40. ATM	324.	325.	325.	321.	317.	312.	307.	303.	298.
10. ATM	320.	320.	319.	314.	310.	306.	301.	297.	293.

図A 5 — 2

CHEMICAL FORMULA	WT PERCENT	ENERGY STATE CAL/MOL	TEMP DEG K		DENSITY G/CC
N 2.0 H 8.0 C 2.0	50.	11900.0	L 298.15	F	0.783
N 2.0 H 4.0	50.	12100.0	L 298.15	F	1.0036
N 2.0 O 4.0	100.	-4680.0	L 298.15	O	1.431





******** CF(V)S ****** ((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=1.4-3.0, AE/AT=10.-100. (EMAX.LT.1.2%)
A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

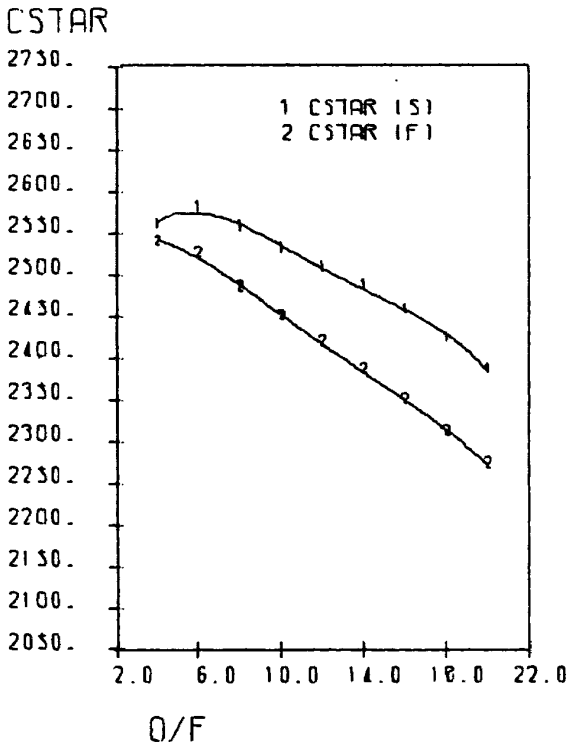
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3433813E 01	0.1382364E-01	0.5340017E-04	0.1525998E-05	-0.1250684E-07
J= 2	-0.3717240E 01	-0.1865720E-01	-0.3270071E-03	0.1439151E-07	0.1029639E-07
J= 3	0.2749379E 01	0.2212375E-01	0.5546467E-04	0.1430914E-05	-0.1120925E-07
J= 4	-0.8699881E 00	-0.7462803E-02	-0.6349045E-05	-0.4466520E-06	0.2985630E-08
J= 5	0.9995127E-01	0.7568896E-03	0.2799994E-05	0.1809601E-07	-0.1636028E-09

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.1175408E-01	0.7525710E-03	0.2939617E-06	-0.1222167E-06	0.5540308E-09
J= 2	0.2351521E-01	-0.1420390E-02	0.2428012E-07	0.2123568E-06	-0.9120705E-09
J= 3	-0.1731541E-01	0.9828567E-03	-0.4902215E-06	-0.1325345E-06	0.5281343E-09
J= 4	0.5524565E-02	-0.2997097E-03	0.3808418E-06	0.3453760E-07	-0.1239879E-09
J= 5	-0.6460538E-03	0.3390494E-04	-0.7416798E-07	-0.3171769E-08	0.9679265E-11

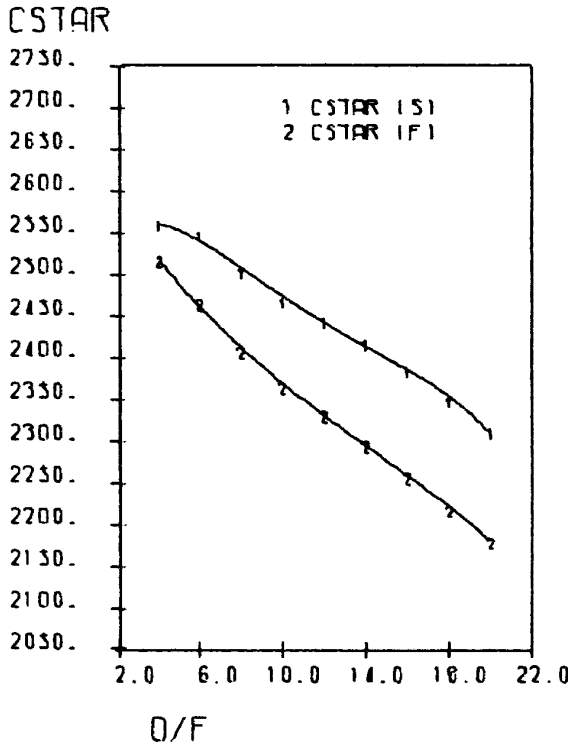
CF(V) AE/AT=50.	O/F								
EQUILIBRIUM	1.40	1.50	1.75	2.00	2.20	2.40	2.60	2.80	3.00
80. ATM	1.856	1.864	1.893	1.931	1.961	1.950	1.946	1.935	1.926
60. ATM	1.855	1.865	1.895	1.934	1.964	1.960	1.949	1.938	1.927
40. ATM	1.857	1.866	1.898	1.939	1.968	1.965	1.953	1.942	1.932
10. ATM	1.862	1.875	1.915	1.957	1.984	1.980	1.969	1.957	1.946
FROZEN									
80. ATM	1.838	1.845	1.854	1.860	1.862	1.863	1.862	1.861	1.860
60. ATM	1.838	1.843	1.853	1.858	1.860	1.861	1.861	1.861	1.860
40. ATM	1.837	1.842	1.852	1.857	1.859	1.860	1.860	1.859	1.858
10. ATM	1.833	1.837	1.845	1.850	1.851	1.852	1.852	1.853	1.851

図A 5－3

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2134.00	L	20.27	F	0.0709
F	2.0	100.00	-3098.00	L	85.02	O	1.3050



80.ATM



10.ATM

******** CSTAR(S) ****** (A(I,J),J=1,5),I=1,3) **********

PC=80.ATM-10.ATM. O/F=4.0-20.0 (EMAX.LT.0.4%)

A(I,J) =(PC)**(I-1)*(O/F)**(J-1)

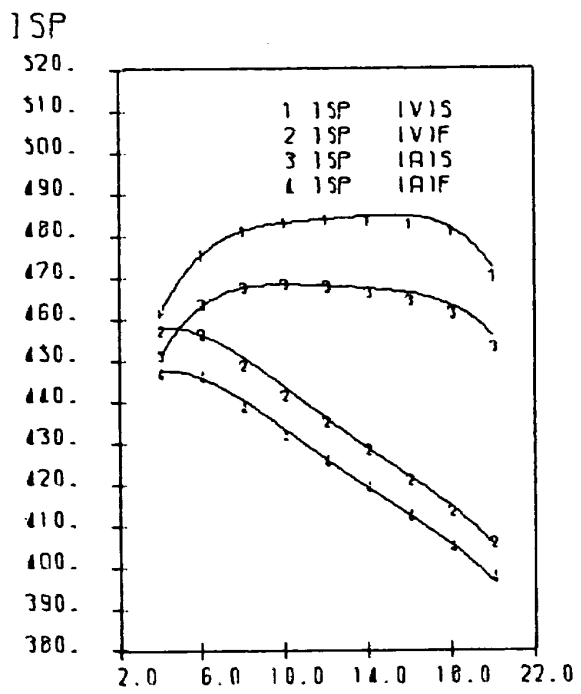
	J=1	J=2	J=3	J=4	J=5
I= 1	0.2371004E 04	0.1150932E 02	-0.4732311E 01	0.3129827E 00	-0.6980366E-02
I= 2	-0.4669463E 01	0.1844839E 01	-0.1909207E 00	0.8941127E-02	-0.1363485E-03
I= 3	0.3054043E-01	-0.1235740E-01	0.1312742E-02	-0.6261244E-04	0.1110669E-05

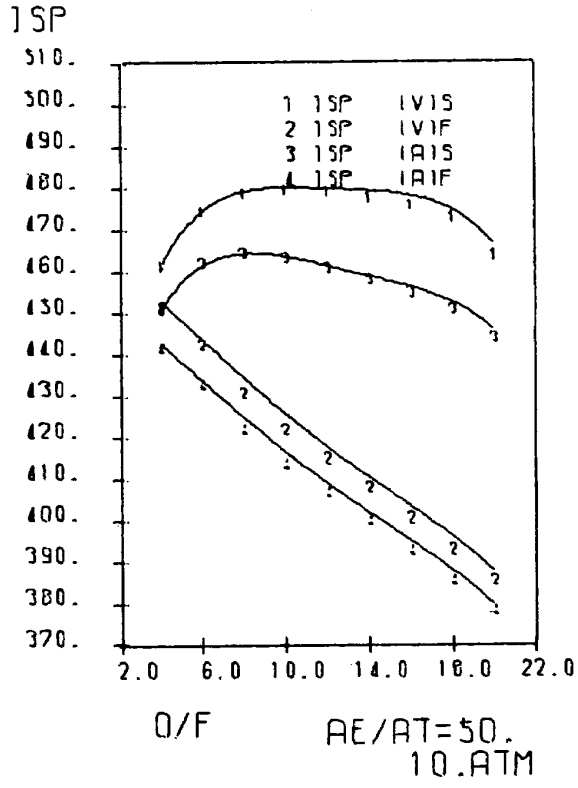
CSTAR AE/AT=50.

EQUILIBRIUM	O/F 4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00
80. ATM	2562.	2382.	2338.	2332.	2310.	2288.	2459.	2425.	2387.
60. ATM	2562.	2378.	2331.	2323.	2301.	2278.	2449.	2414.	2376.
40. ATM	2562.	2372.	2340.	2311.	2288.	2264.	2434.	2399.	2361.
10. ATM	2558.	2345.	2300.	2265.	2240.	2214.	2382.	2345.	2306.

図 A 6－1

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2134.00	L	20.27	F	0.0709
F	2.0	100.00	-3098.00	L	85.02	O	1.3050





******** ISPIVIS ****** (((AI).J.K).K=1.5).J=1.5).I=1.2) **********

PC=80.ATM-10.ATM. O/F=4.0-20.0. AE/AT=10.-100. (EMAX.LT.0.9%)
AI).J.K)=(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

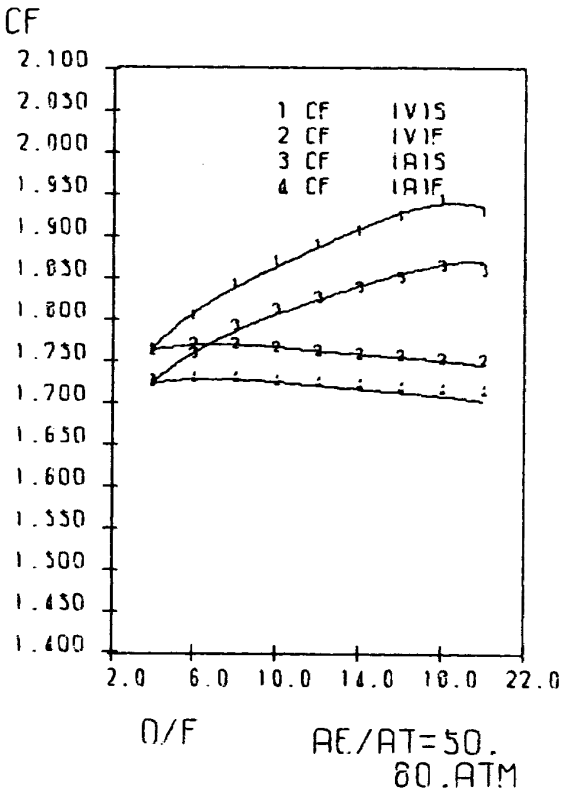
I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.3689327E 03	0.1280484E 01	-0.3052391E-01	0.3151193E-03	-0.1192807E-05
J= 2	0.2142111E 02	0.4086436E 00	-0.9172807E-02	0.1057344E-03	-0.4379804E-06
J= 3	-0.3036831E 01	-0.1606113E-01	0.3123402E-03	-0.4276660E-05	0.2376714E-07
J= 4	0.1645276E 00	0.6027721E-04	0.7345669E-05	0.2673122E-09	-0.3270816E-09
J= 5	-0.3202590E-02	0.5652286E-05	-0.4246007E-06	0.3150263E-08	-0.5539448E-11

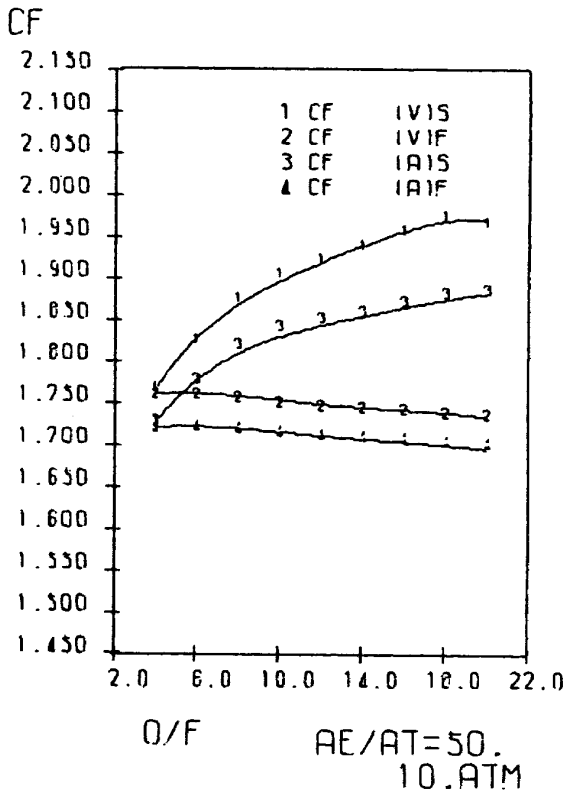
I=2	K=1	K=2	K=3	K=4	K=5
J= 1	-0.1066051E-01	0.6014708E-03	-0.9384744E-04	0.1563463E-05	-0.7180361E-08
J= 2	-0.9726621E-02	0.1440316E-03	0.3420607E-04	-0.7090661E-06	0.3350616E-08
J= 3	0.5707101E-02	-0.2756176E-03	-0.1063760E-05	0.7299981E-07	-0.4370677E-09
J= 4	-0.4304332E-03	0.2547906E-04	-0.1293581E-06	-0.2686010E-08	0.2100734E-10
J= 5	0.9725687E-05	-0.6680590E-06	0.5773581E-08	0.2831923E-10	-0.3503401E-12

ISPIVI AE/AT=50.		O/F							
EQUILIBRIUM	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00
80. ATM	461.	475.	481.	483.	484.	484.	483.	481.	470.
60. ATM	461.	475.	481.	483.	483.	483.	482.	480.	469.
40. ATM	461.	475.	480.	482.	482.	482.	481.	479.	468.
10. ATM	461.	474.	479.	480.	479.	478.	476.	473.	464.
FROZEN									
80. ATM	457.	456.	449.	442.	435.	428.	421.	414.	406.
60. ATM	456.	453.	446.	439.	432.	426.	418.	411.	403.
40. ATM	455.	452.	443.	435.	428.	421.	414.	407.	399.
10. ATM	451.	442.	431.	422.	415.	408.	400.	393.	385.

図A 6 − 2

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
F 2.0	100.00	-3098.00	L	85.02	0	1.5050





********* CF(V)S ****** (((A(I,J,K),K=1,5),J=1,5),I=1,2) **********

PC=80.ATM-10.ATM, O/F=4.0-20.0, AE/AT=10.-100. (EMAX.LT.0.8%)

A(I,J,K)*(PC)**(I-1)*(O/F)**(J-1)*(AE/AT)**(K-1)

I=1	K=1	K=2	K=3	K=4	K=5
J= 1	0.1436412E 01	0.4963549E-02	-0.1173650E-03	0.1193875E-05	-0.4453633E-08
J= 2	0.6243980E-01	0.1469930E-02	-0.3333476E-04	0.3945041E-06	-0.1667561E-08
J= 3	-0.7287779E-02	-0.3697819E-04	0.6638942E-06	-0.1383904E-07	0.7826930E-10
J= 4	0.3678865E-03	-0.1095720E-05	0.5894043E-07	-0.2629106E-09	-0.4842852E-12
J= 5	-0.6700134E-05	0.4946400E-07	-0.2309170E-08	0.1818417E-10	-0.3961939E-13

I=2	K=1	K=2	K=3	K=4	K=5
J= 1	0.1156412E-02	0.7642624E-05	-0.4889240E-06	0.2584626E-08	-0.3470276E-10
J= 2	-0.5021453E-03	-0.1374708E-06	0.1787097E-06	-0.3337274E-08	0.1648465E-10
J= 3	0.6784997E-04	-0.9565608E-06	-0.2275721E-08	0.3319606E-09	-0.1950183E-11
J= 4	-0.3735773E-05	0.9536191E-07	-0.3930124E-09	-0.1249491E-10	0.9343806E-13
J= 5	0.7291723E-07	-0.2555266E-08	0.2102621E-10	0.1436692E-12	-0.1570944E-14

CF(V) AE/AT=50. O/F

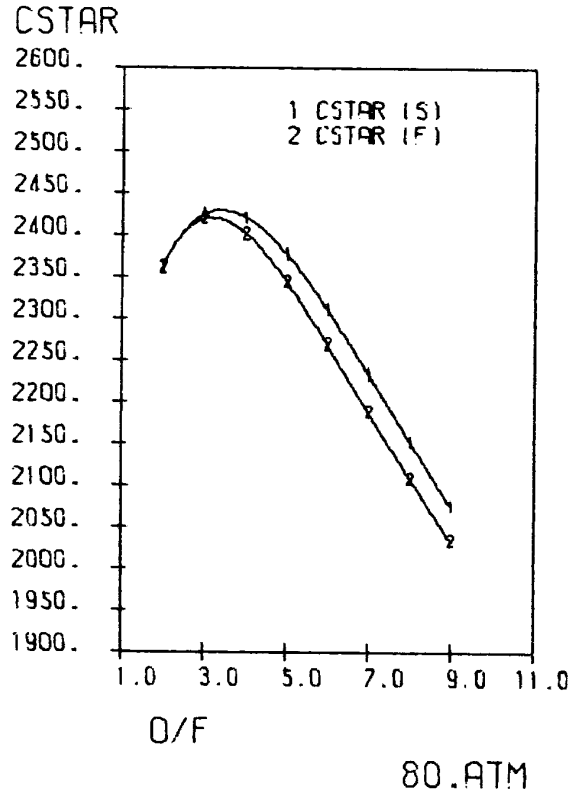
EQUILIBRIUM	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00
80. ATM	1.766	1.805	1.844	1.871	1.890	1.906	1.925	1.945	1.931
60. ATM	1.766	1.807	1.848	1.876	1.895	1.911	1.930	1.950	1.937
40. ATM	1.766	1.811	1.854	1.883	1.901	1.918	1.936	1.956	1.944
10. ATM	1.768	1.827	1.877	1.908	1.925	1.940	1.958	1.977	1.970
FROZEN									
80. ATM	1.763	1.770	1.770	1.767	1.763	1.760	1.757	1.753	1.750
60. ATM	1.762	1.769	1.768	1.764	1.761	1.758	1.754	1.752	1.748
40. ATM	1.762	1.768	1.766	1.761	1.758	1.754	1.751	1.748	1.745
10. ATM	1.760	1.761	1.757	1.752	1.747	1.745	1.742	1.739	1.736

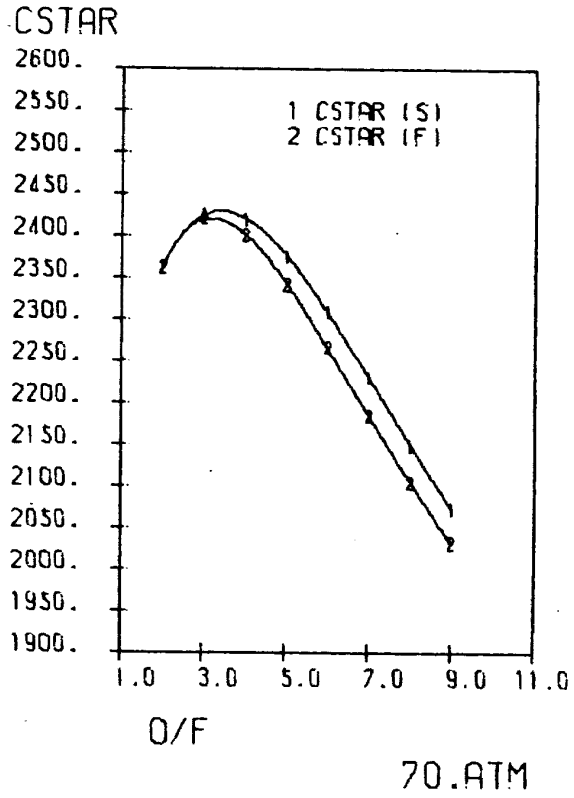
図A 6－3

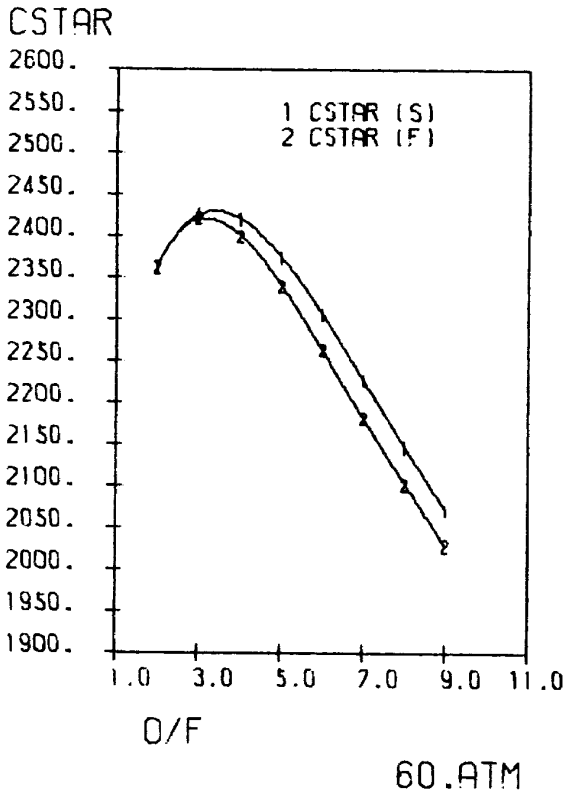
付 録 — B

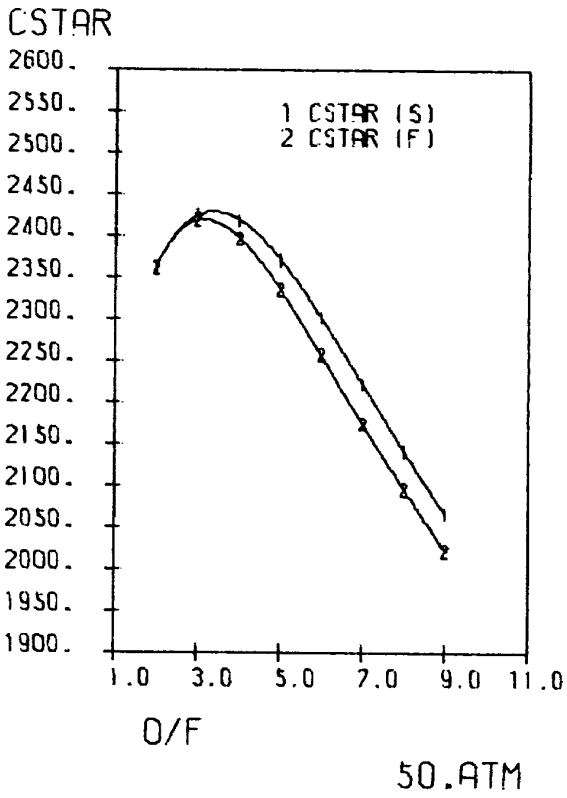
液体酸素／液体水素　プロペラント

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



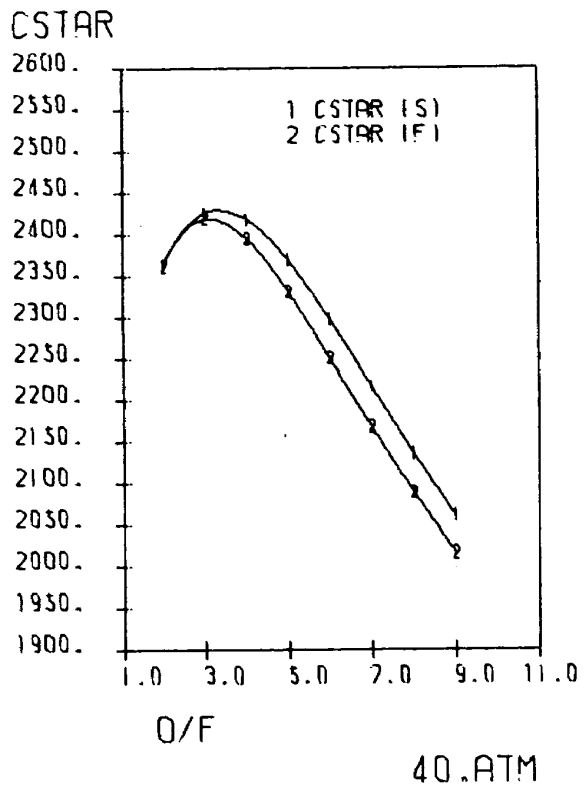


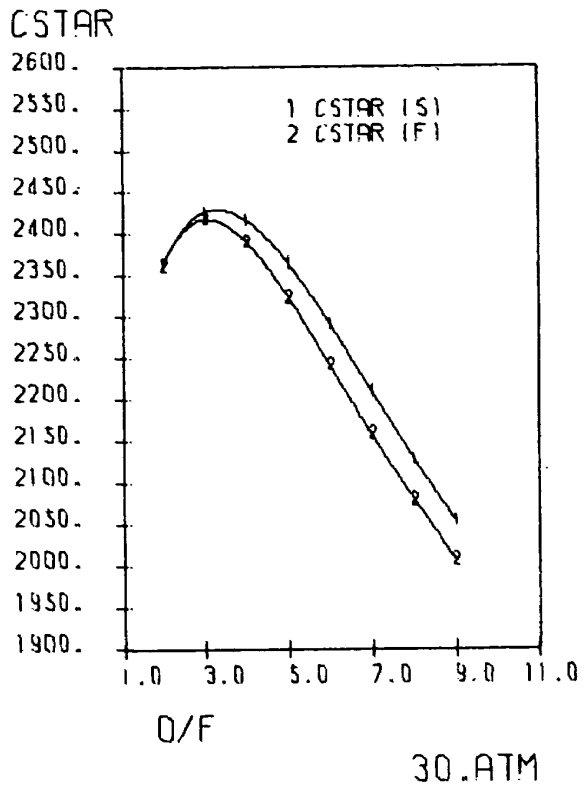


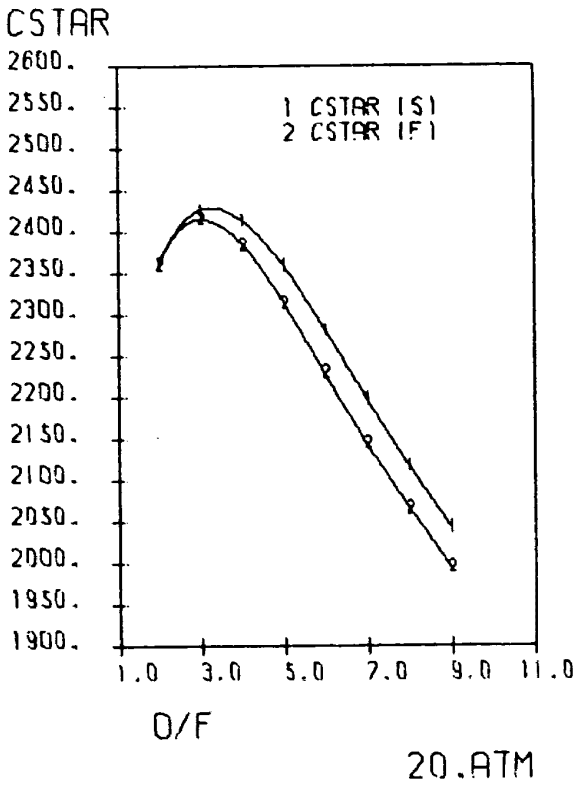


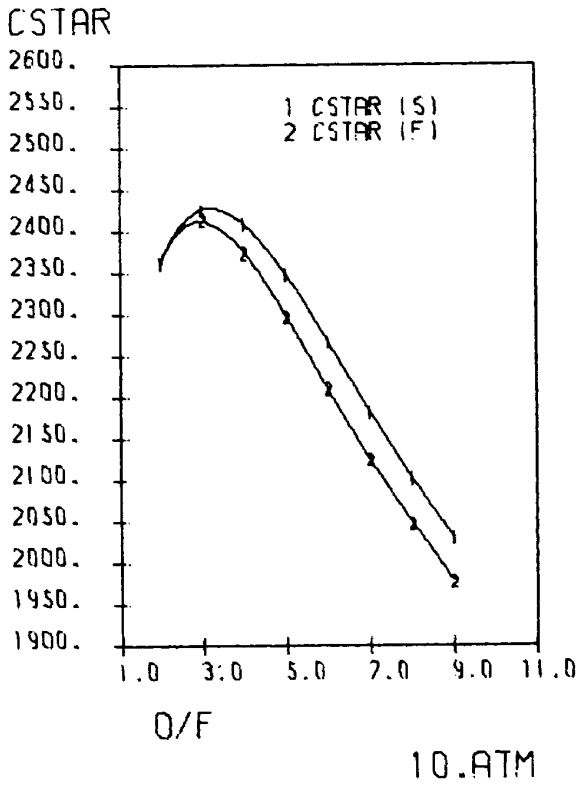
図B 1－1

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



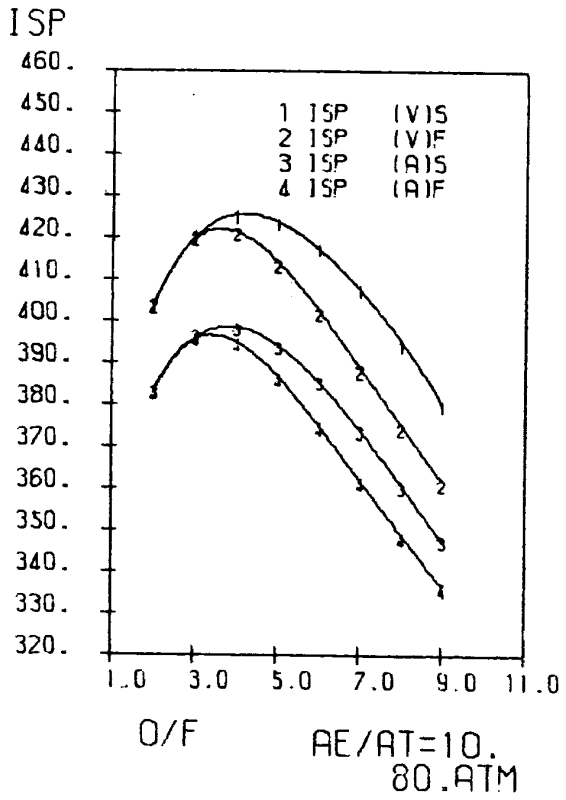


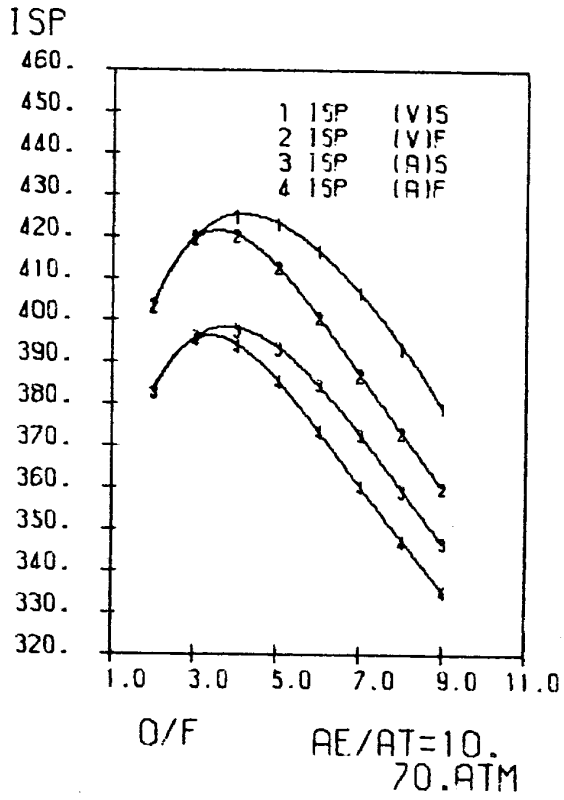


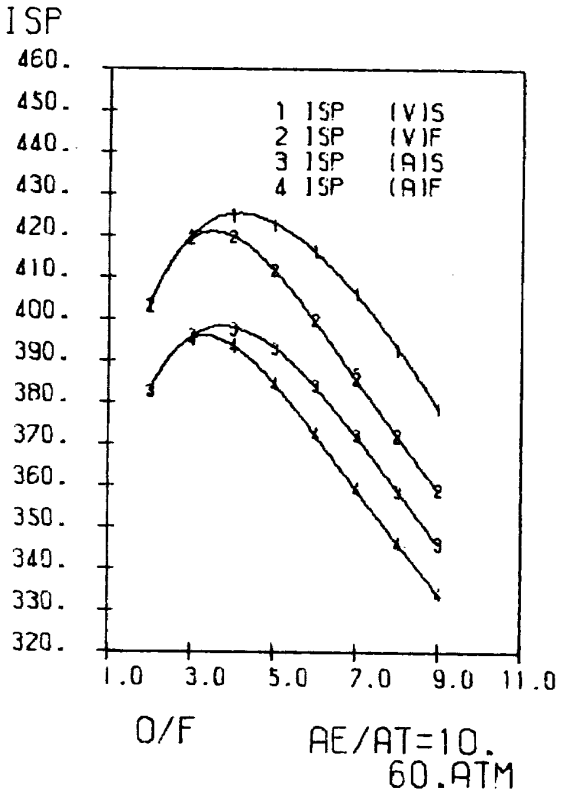


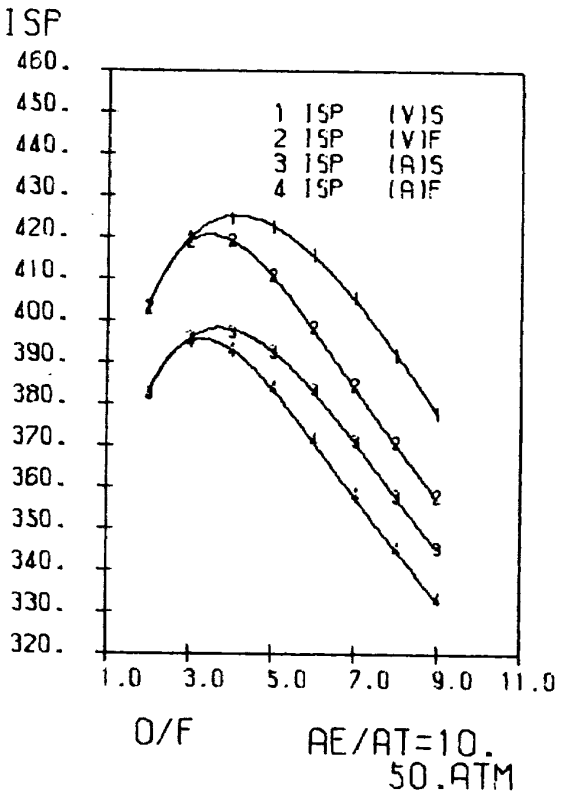
図B 1－2

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490



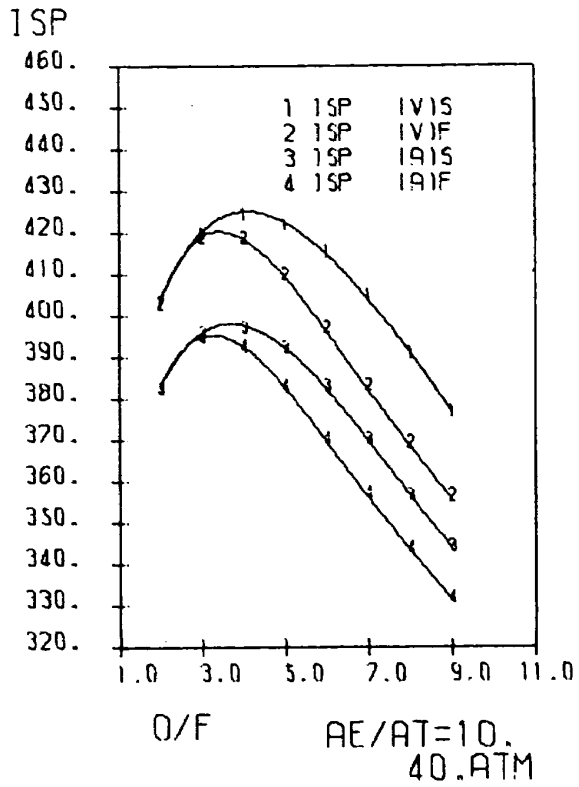


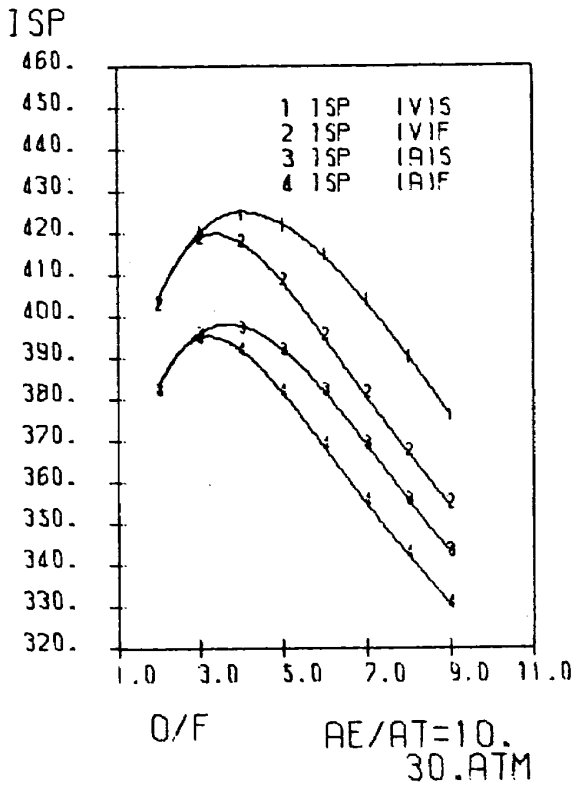


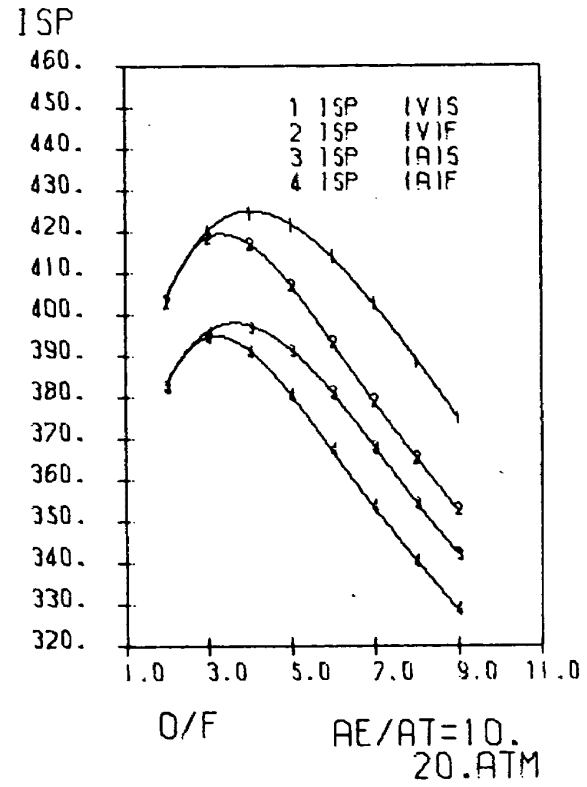


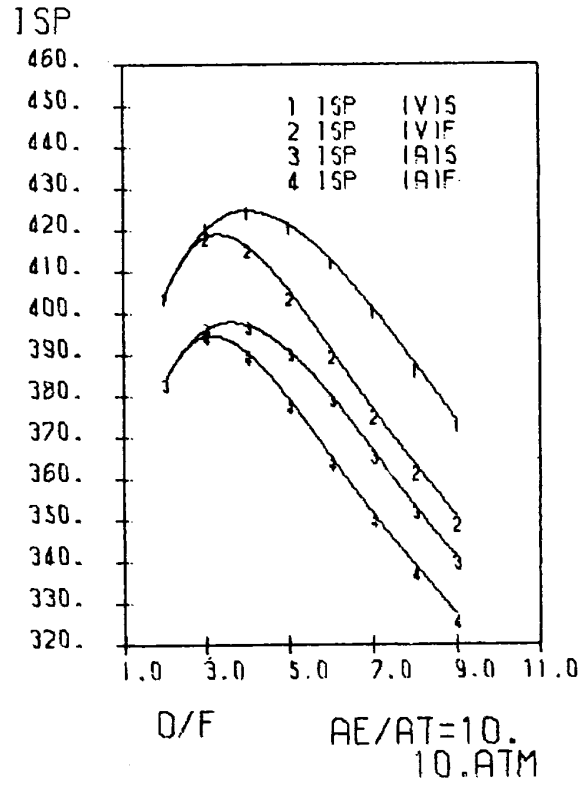
図B 2－1

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



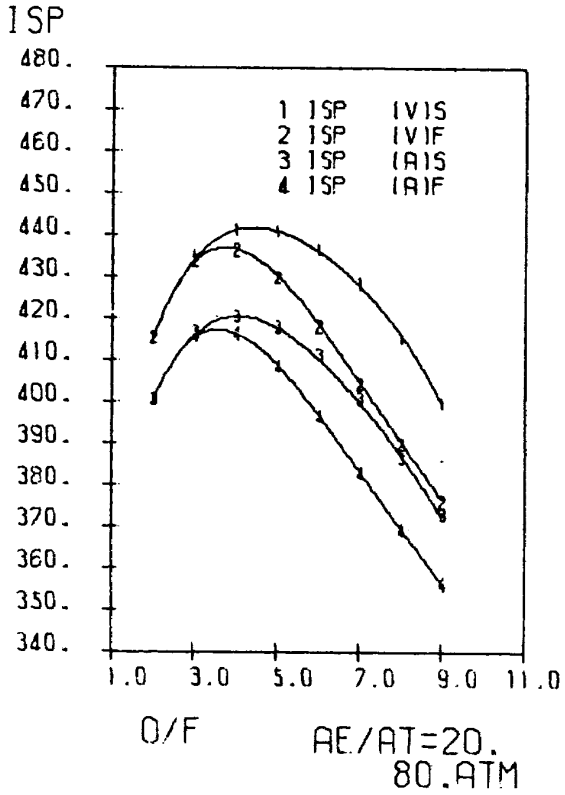


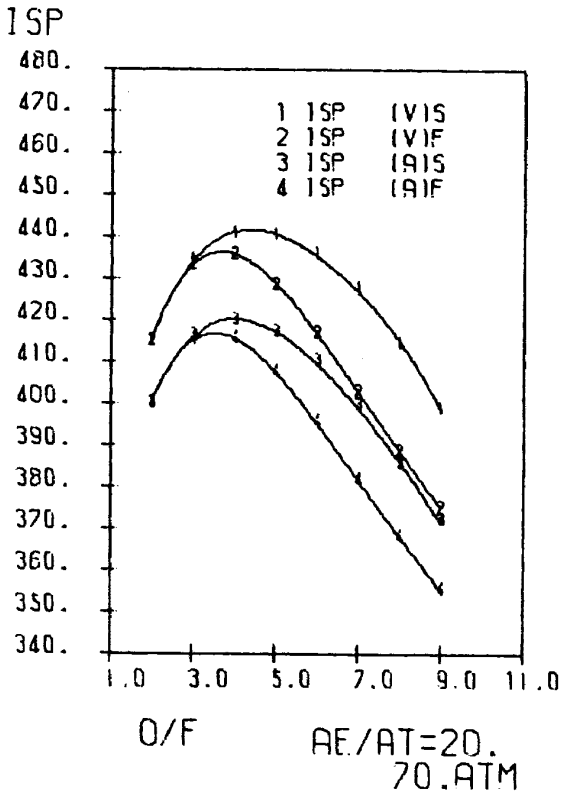


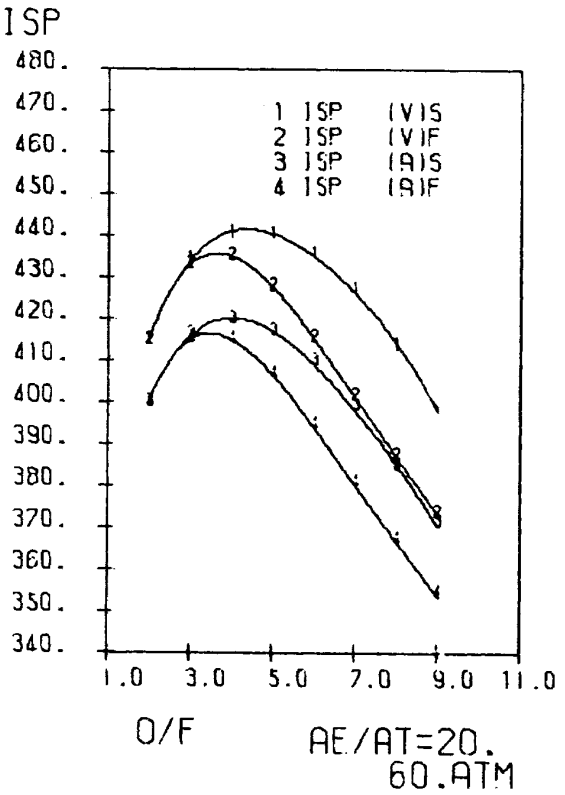


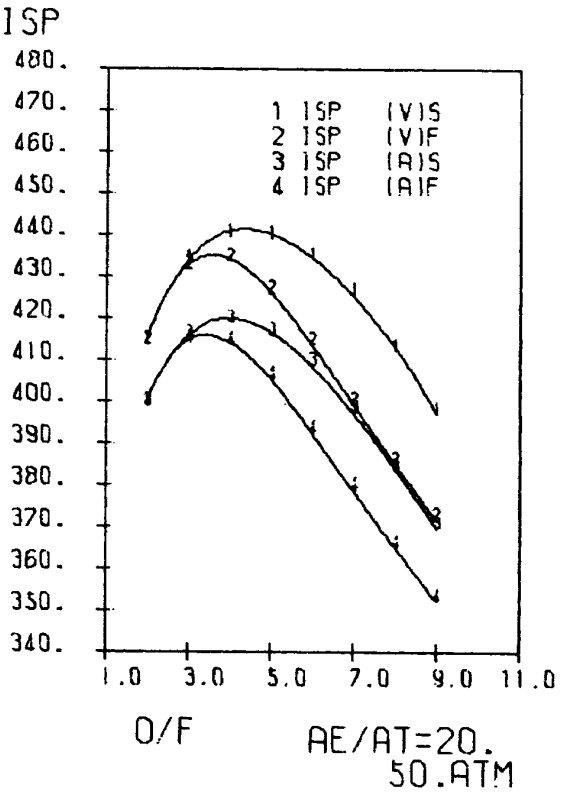
図B 2－2

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



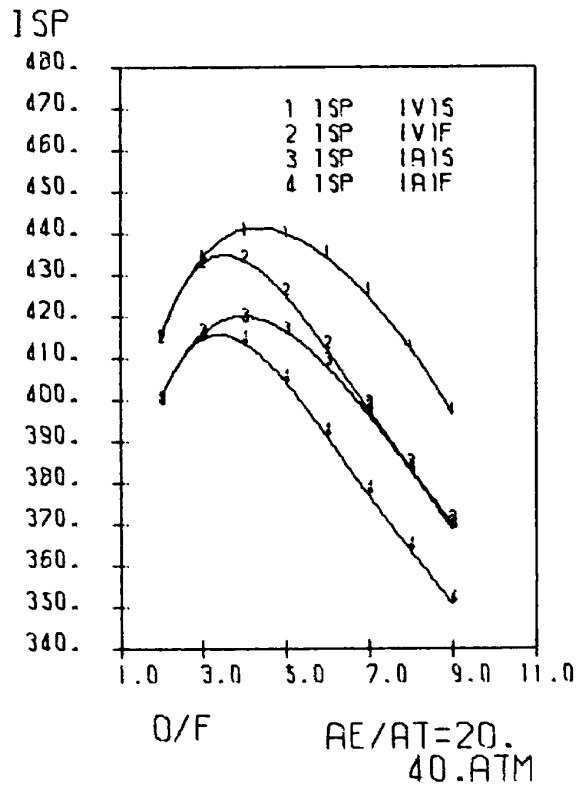


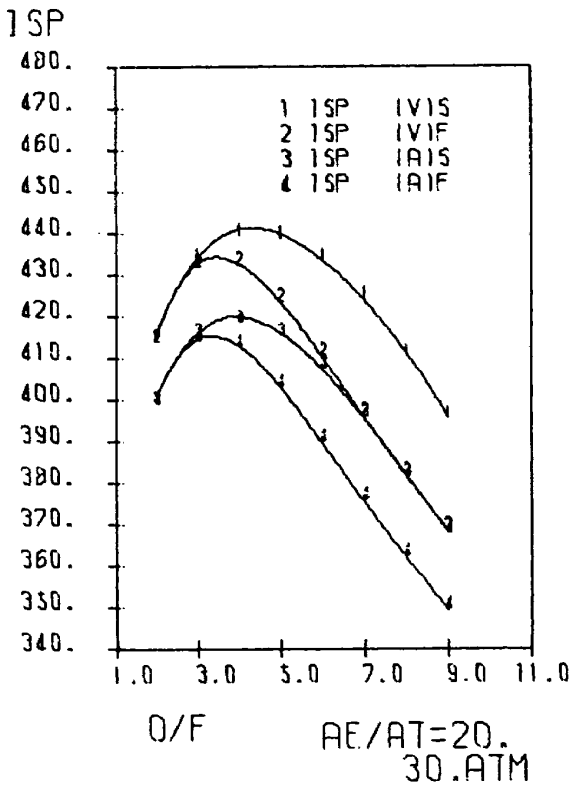


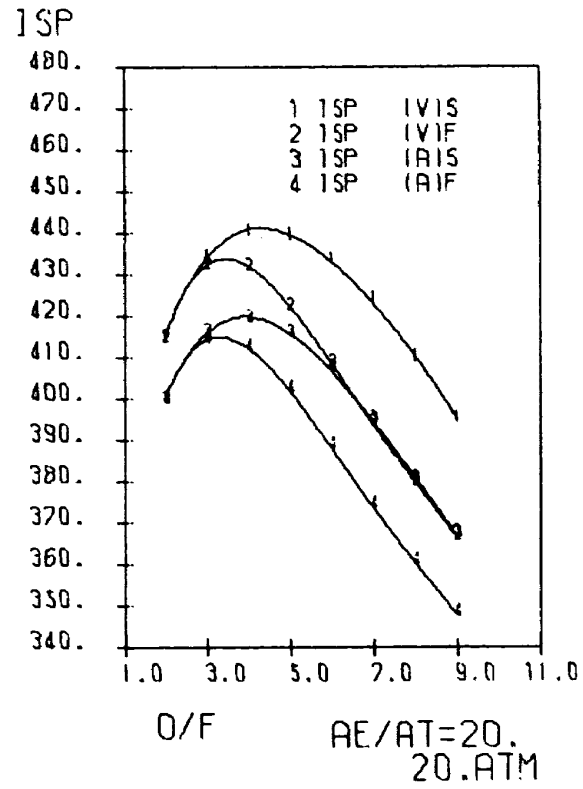


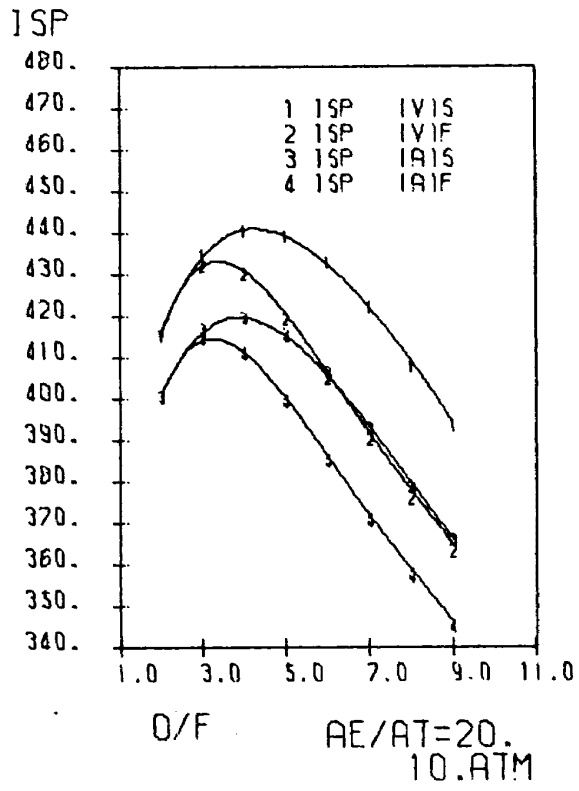
図B 2－3

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



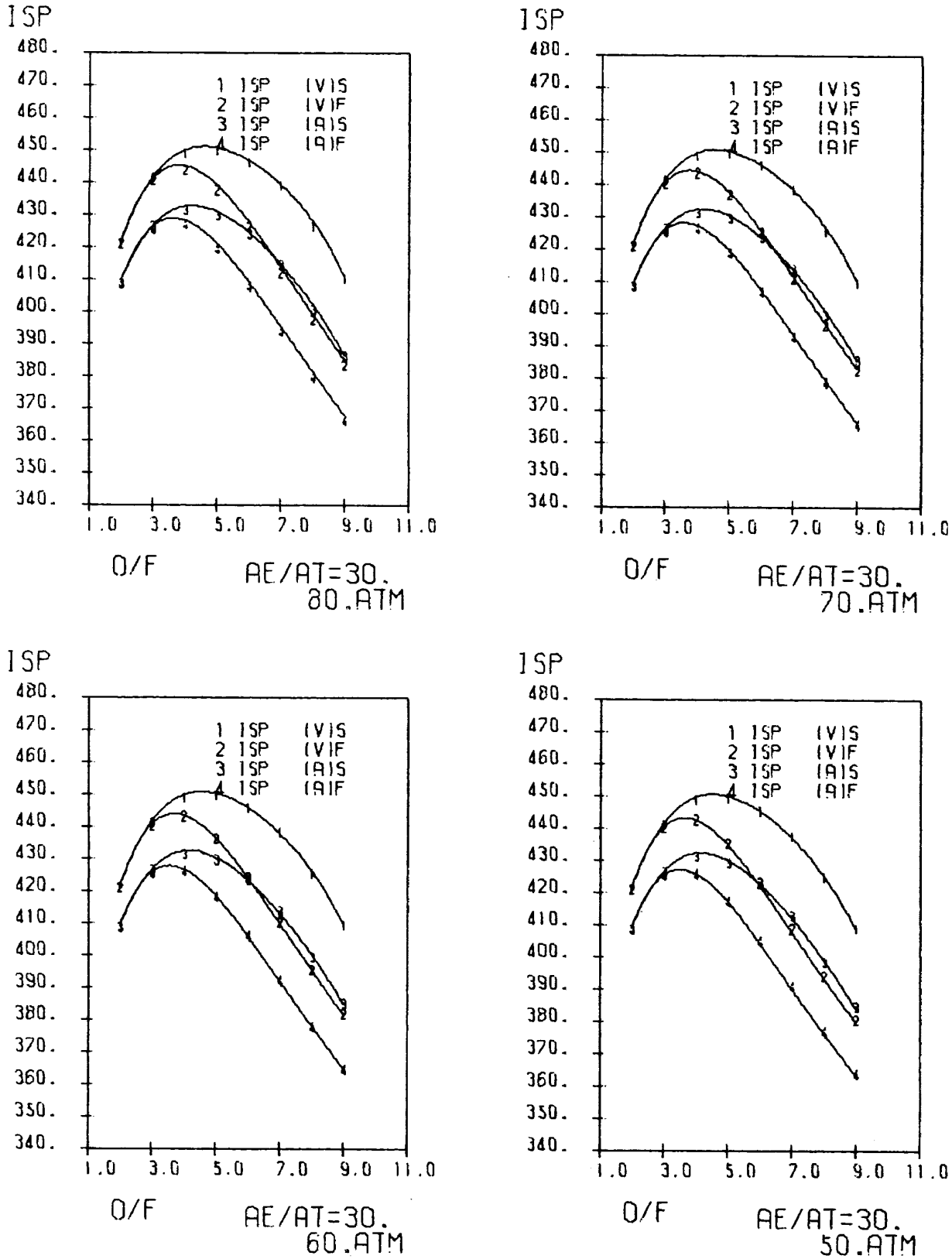






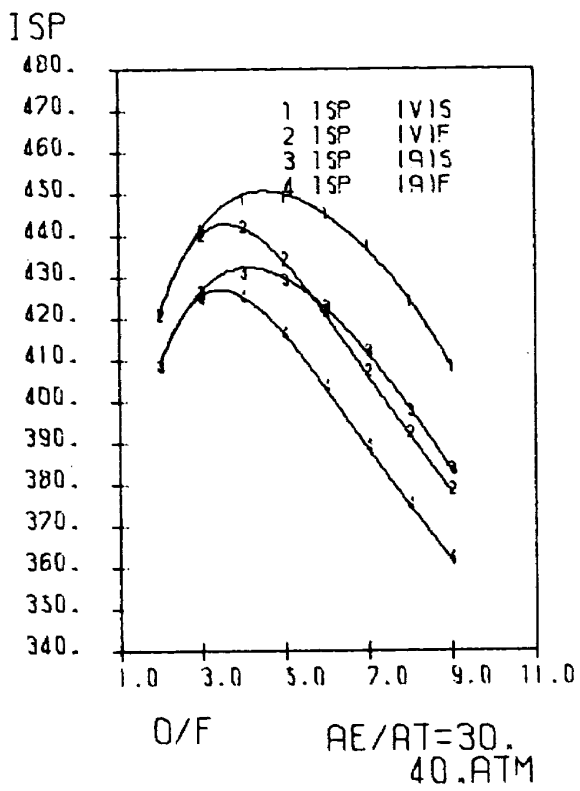
図B 2－4

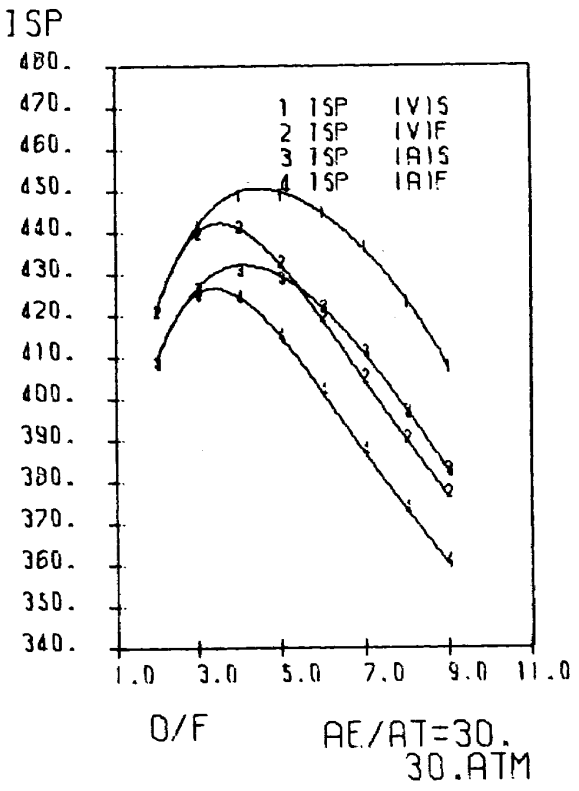
CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0		100.00	-2154.00	L	20.27	F	0.0709
O 2.0		100.00	-3102.00	L	90.18	O	1.1490

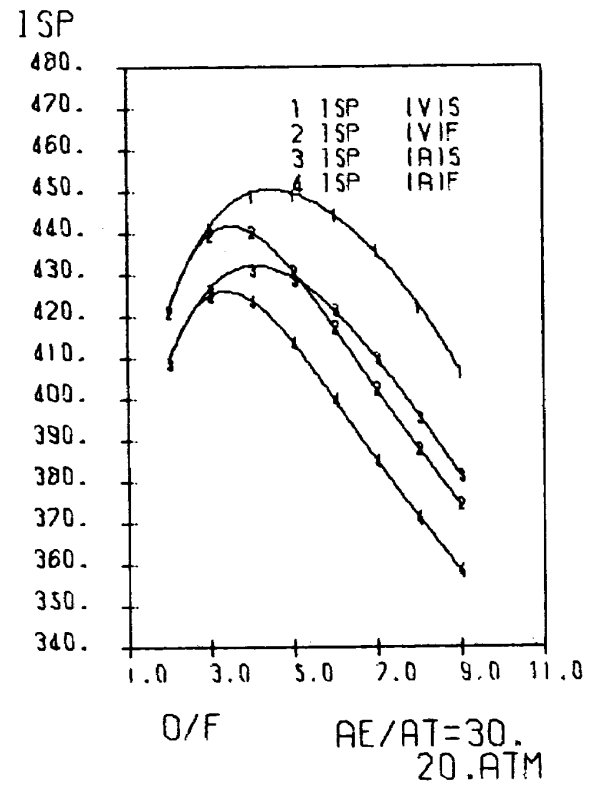


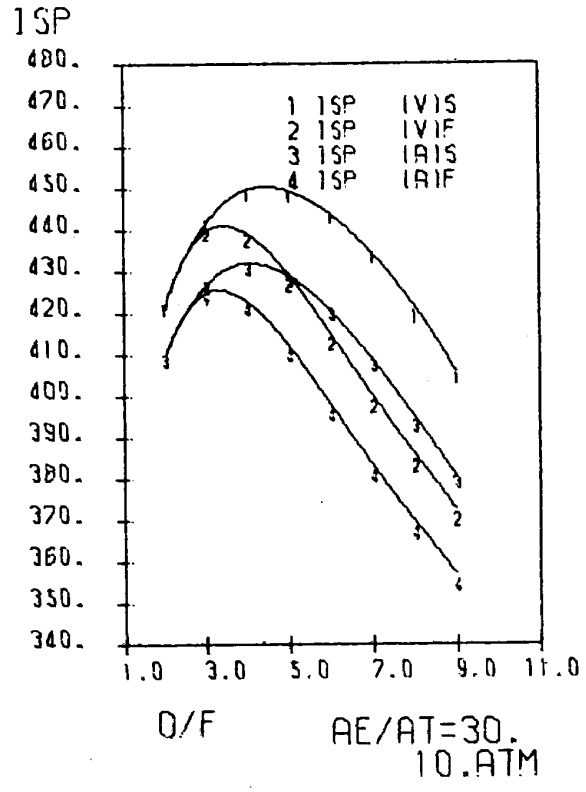
図B 2－5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



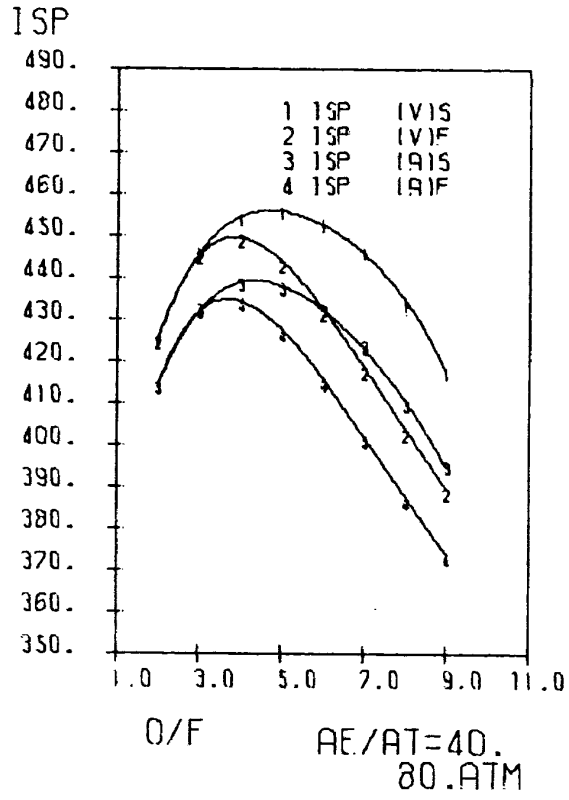


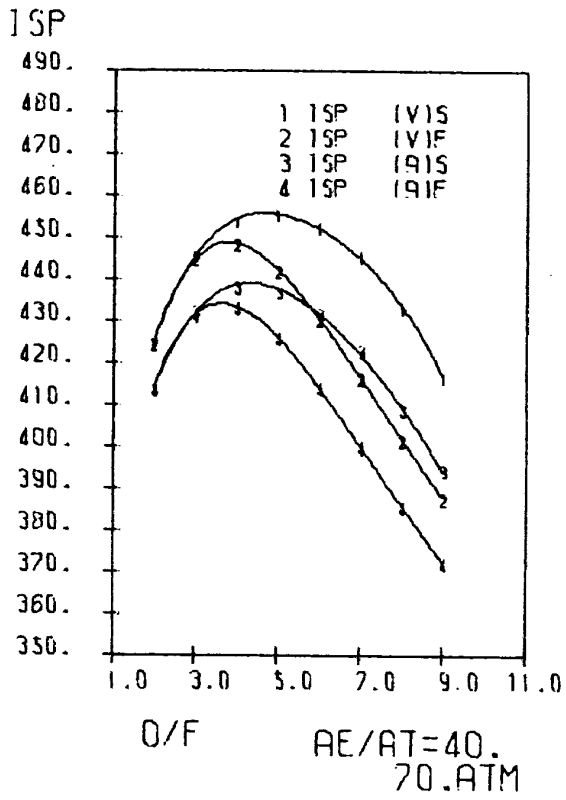


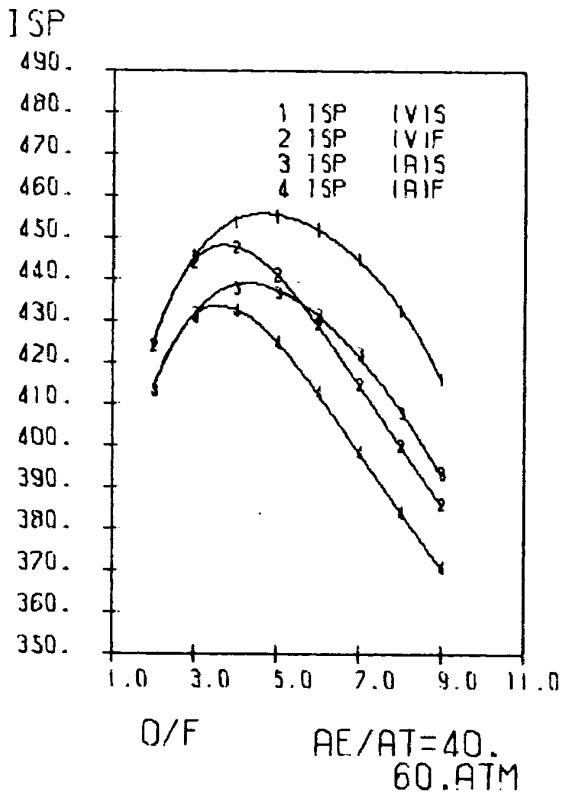


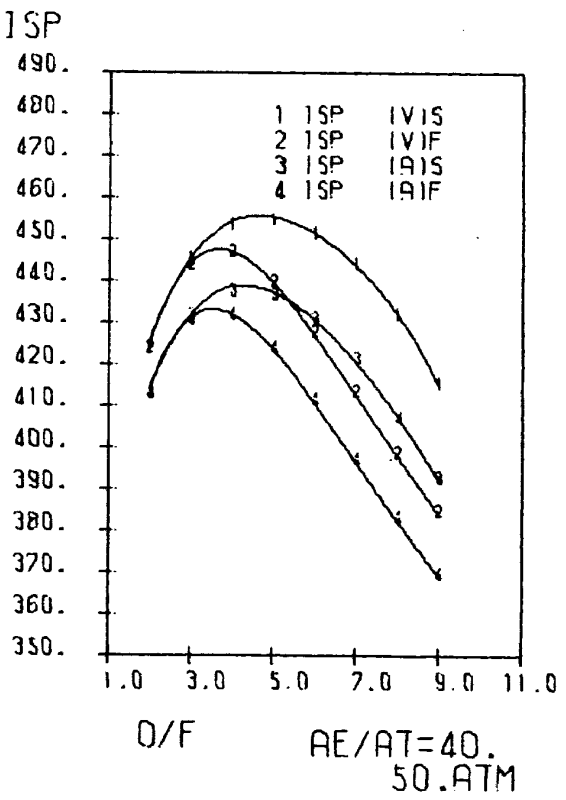
図B 2－6

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



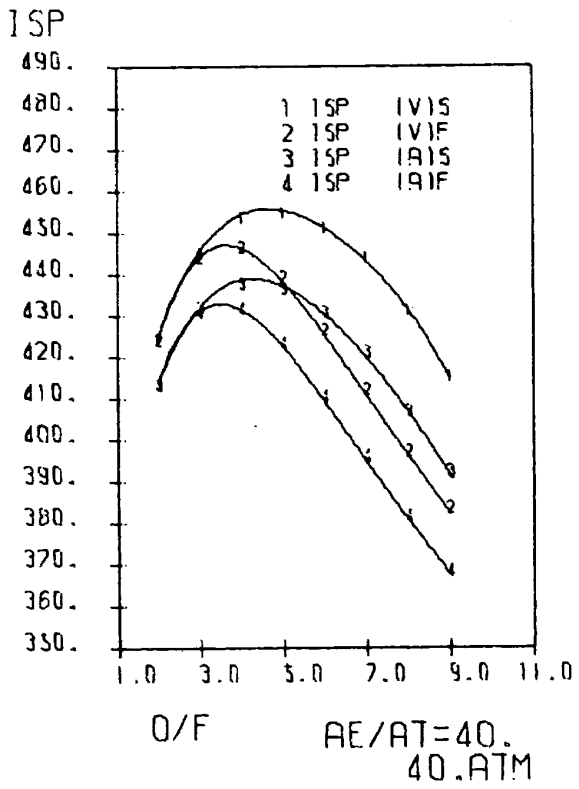


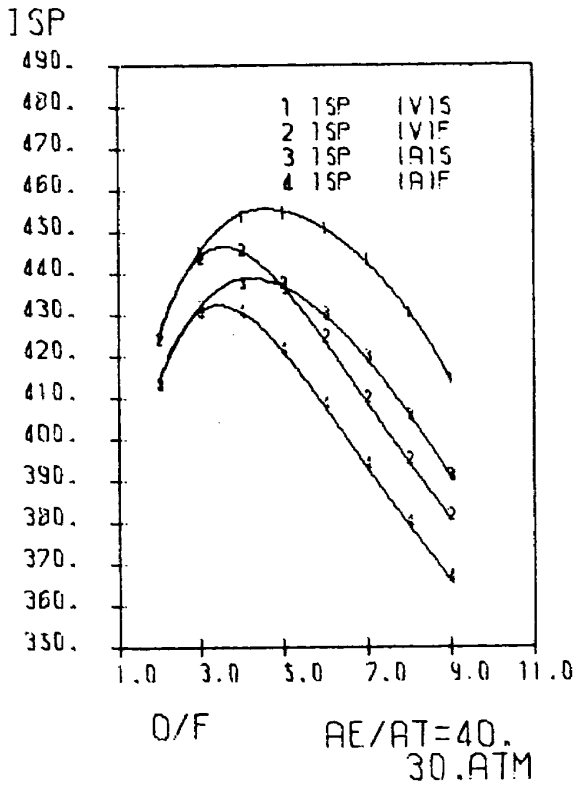


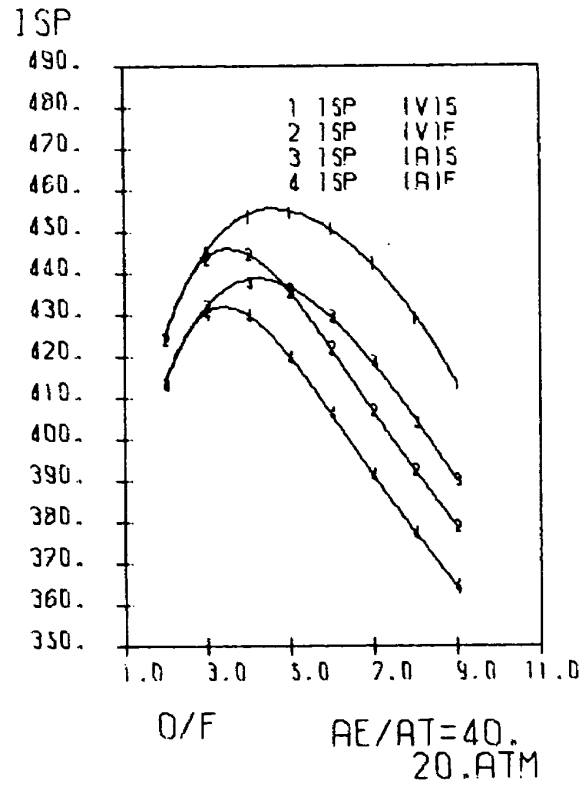


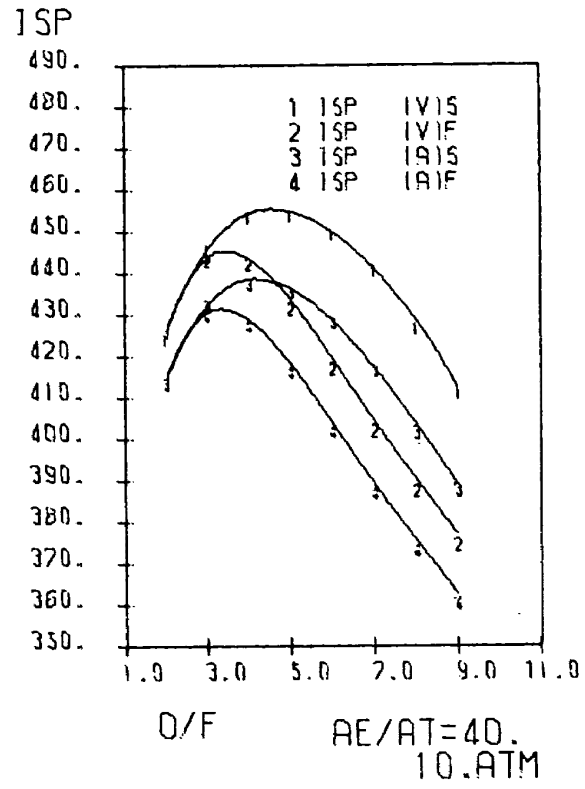
図B 2－7

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



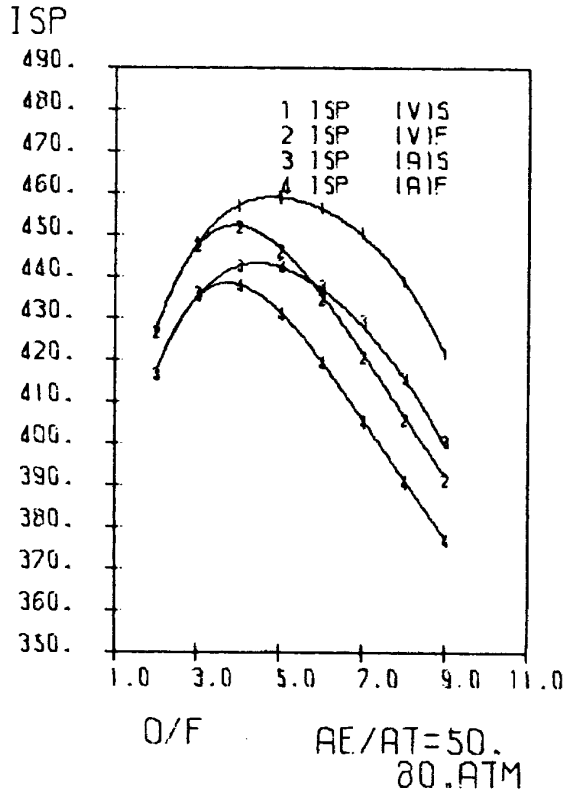


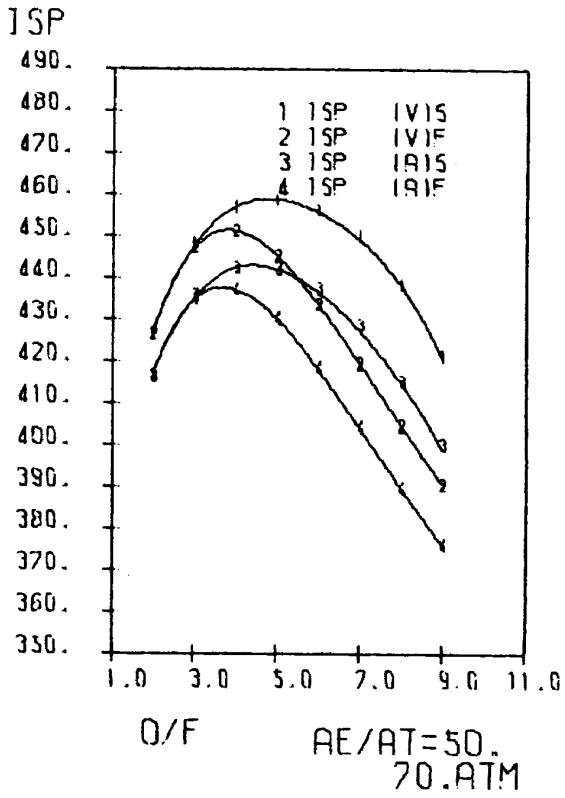


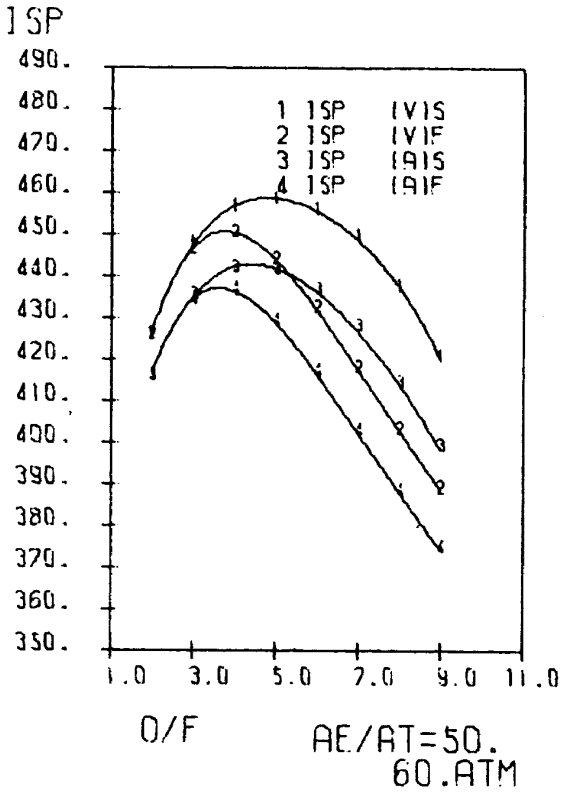


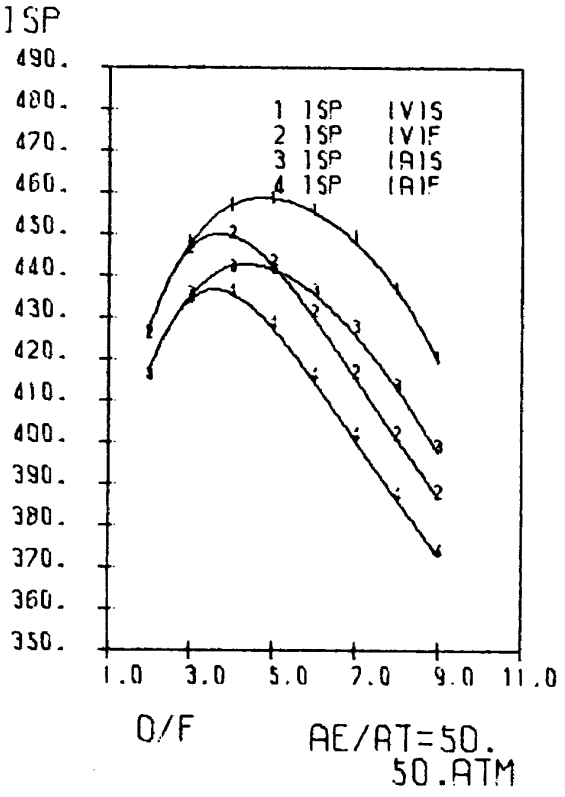
図B 2－8

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490



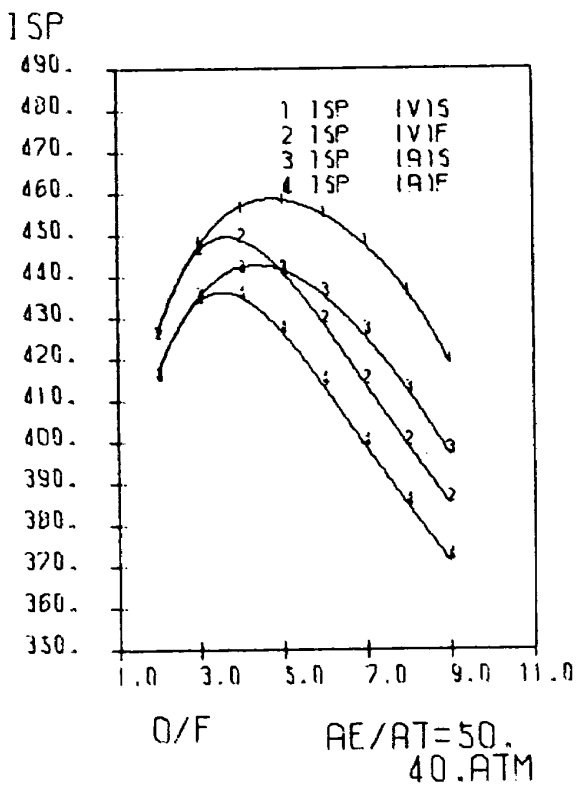


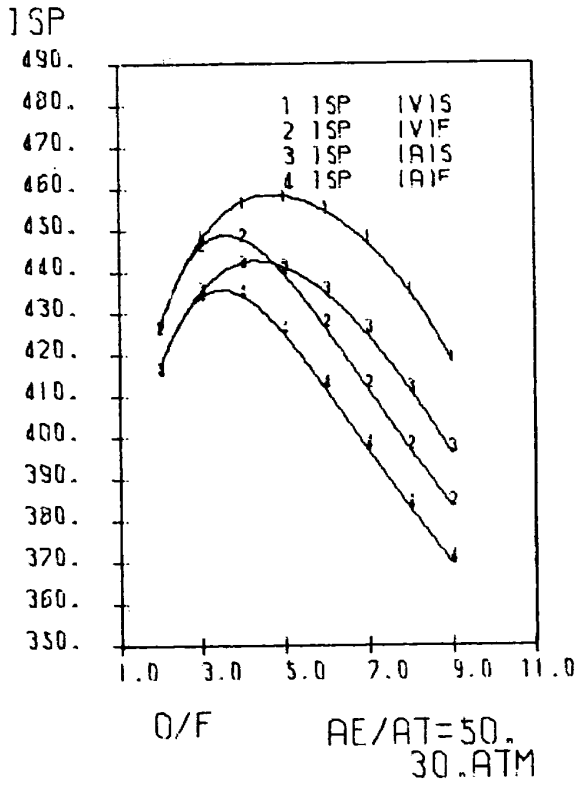


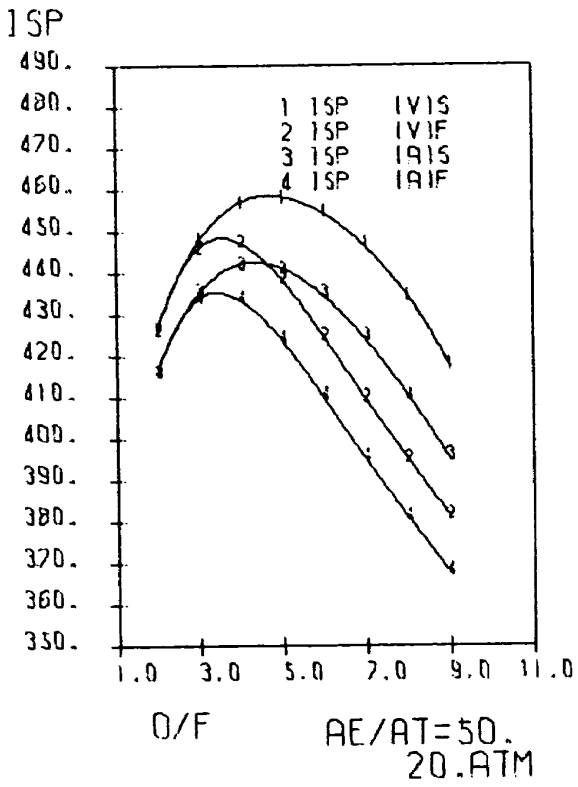


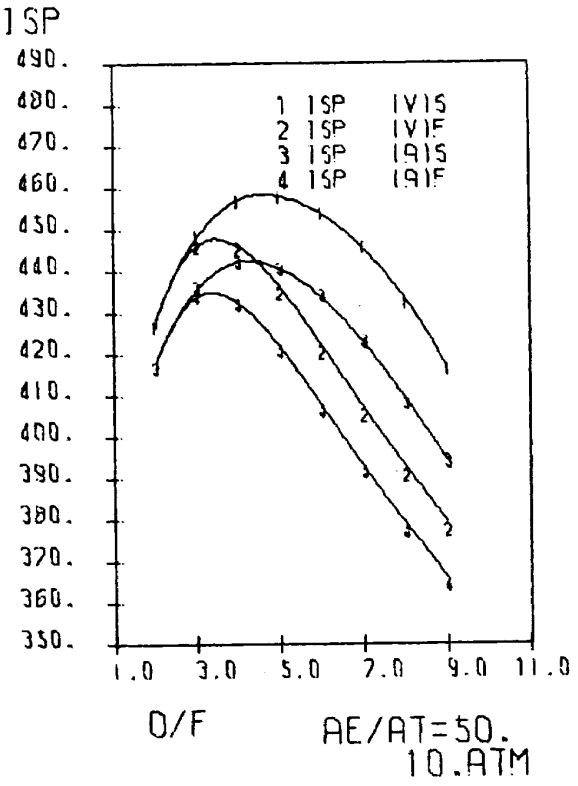
図B 2－9

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



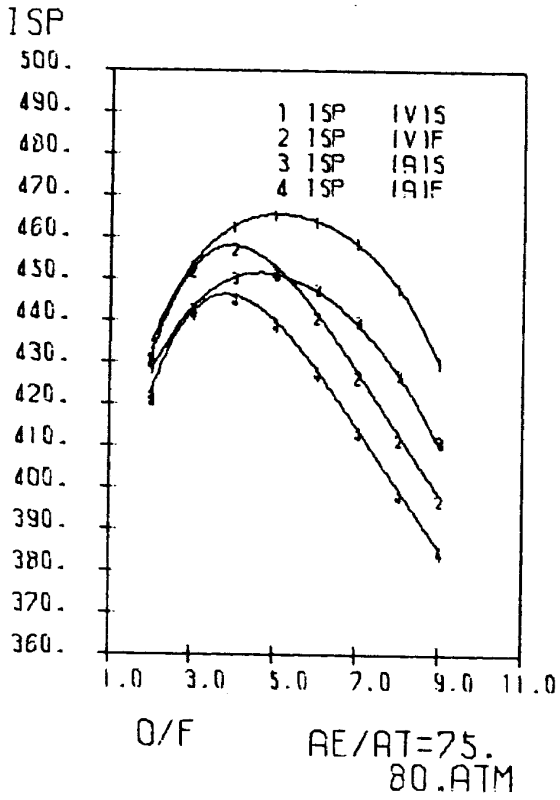


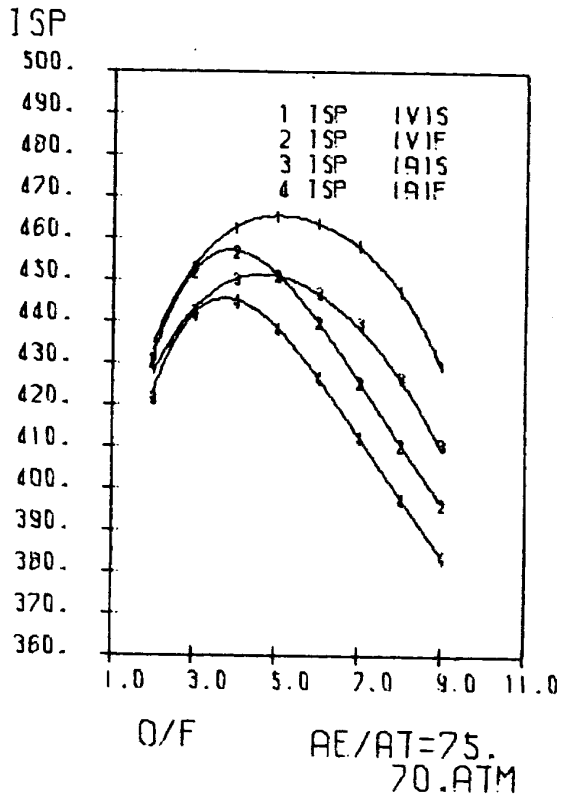


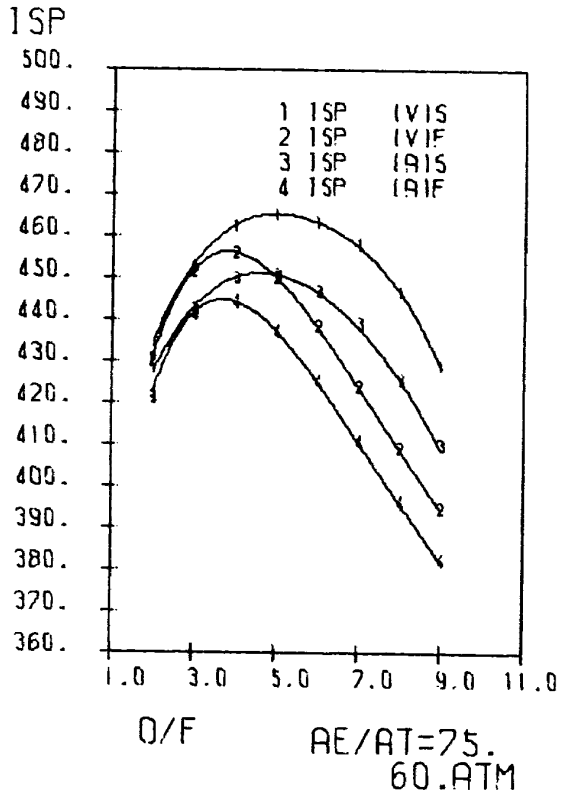


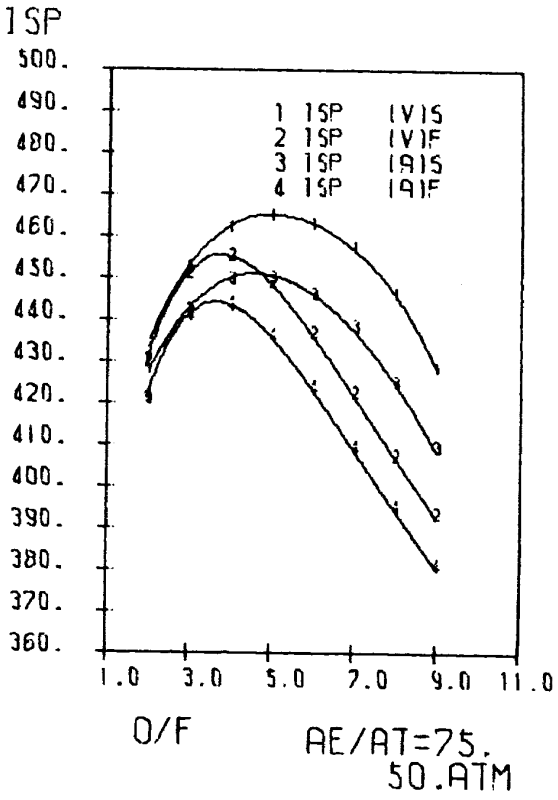
図B 2−10

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



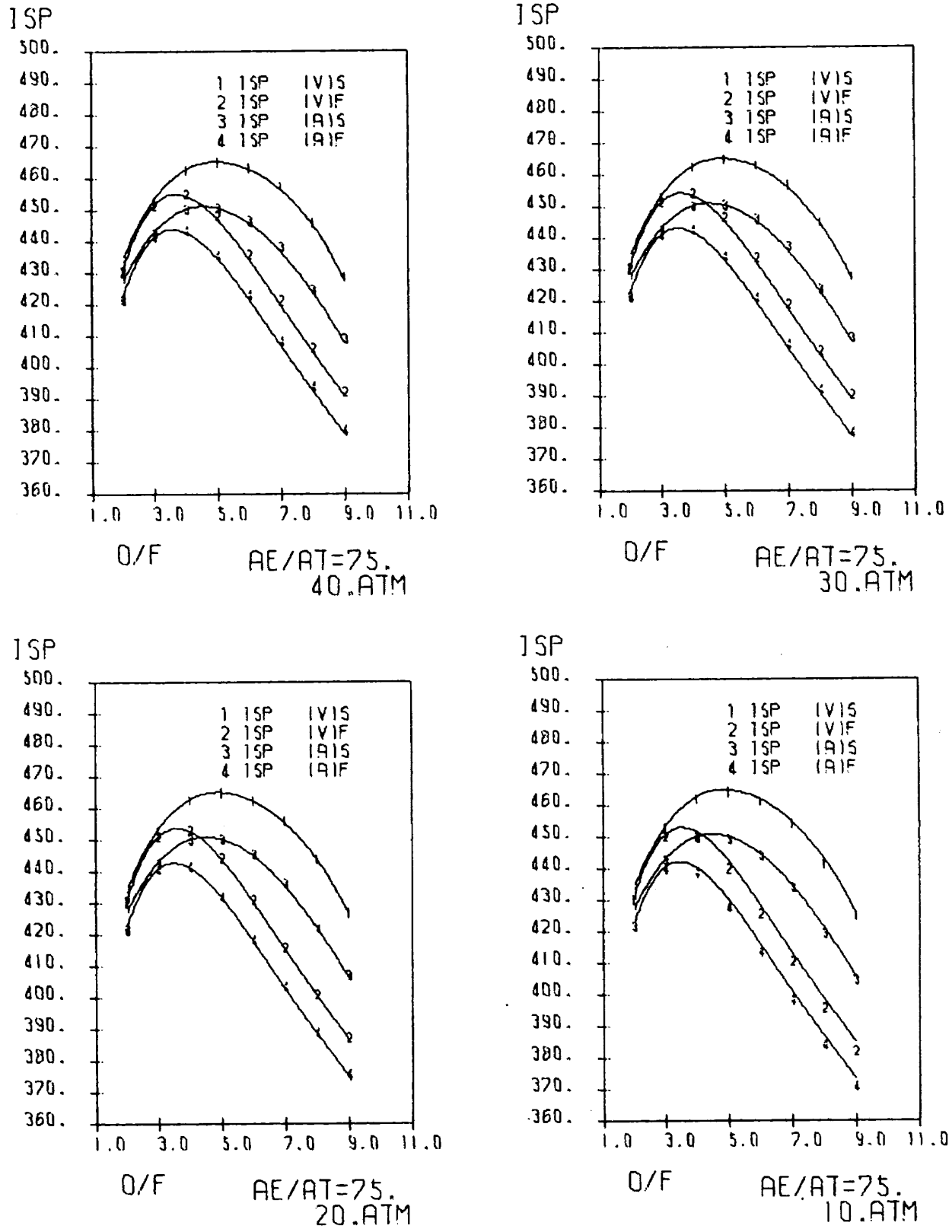






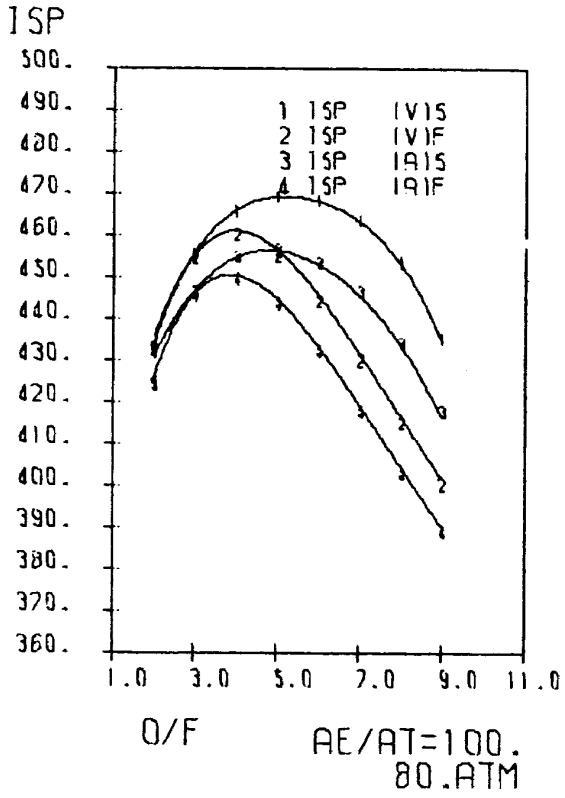
図B 2—11

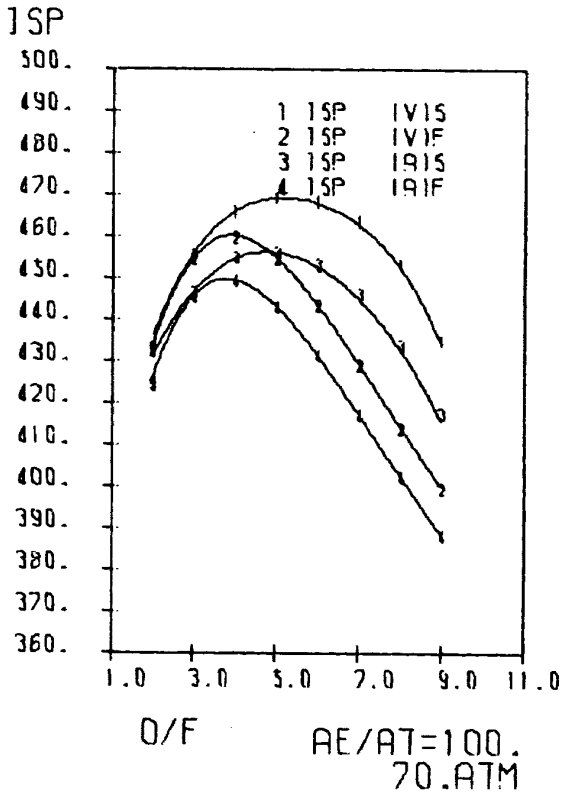
CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490

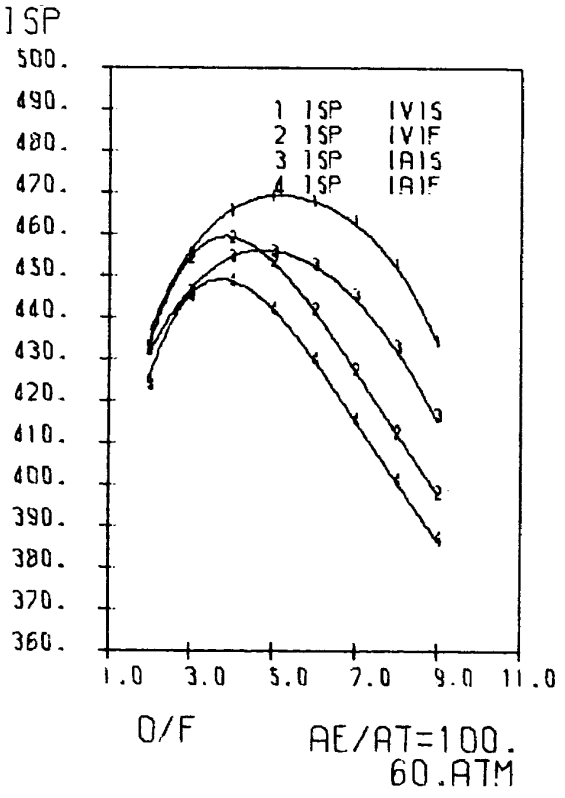


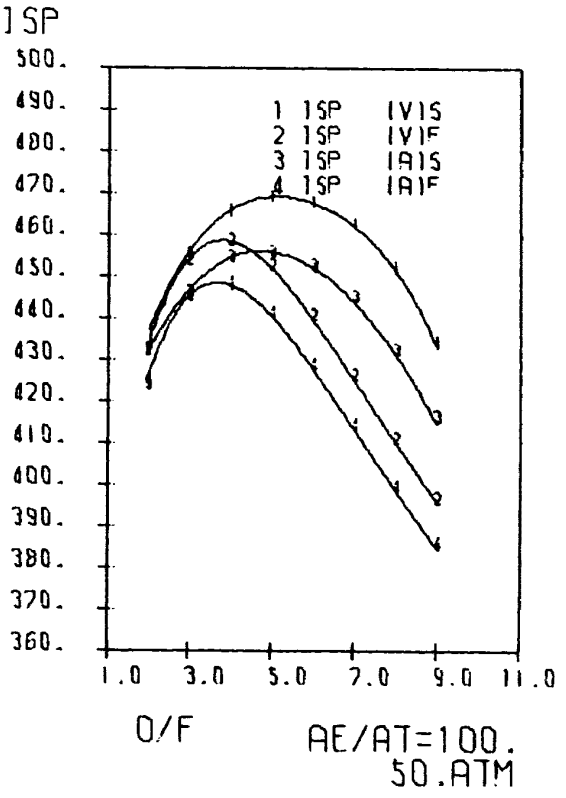
図B 2—12

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



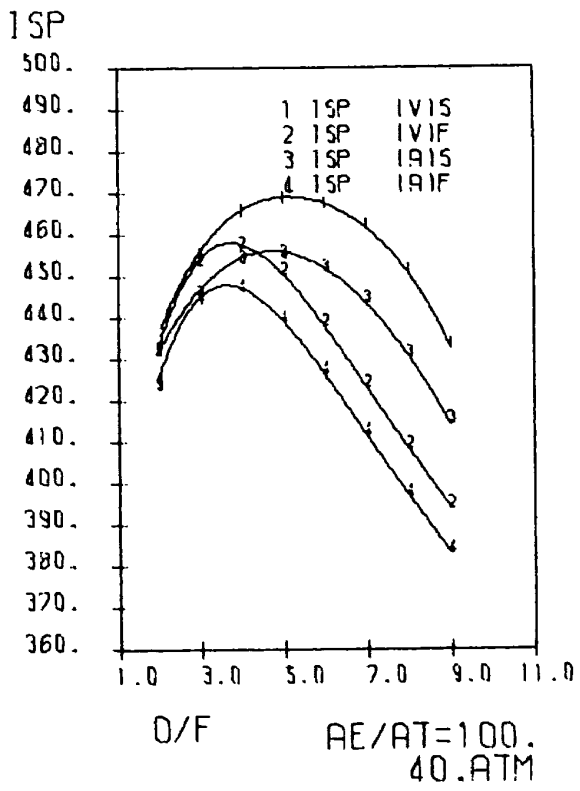


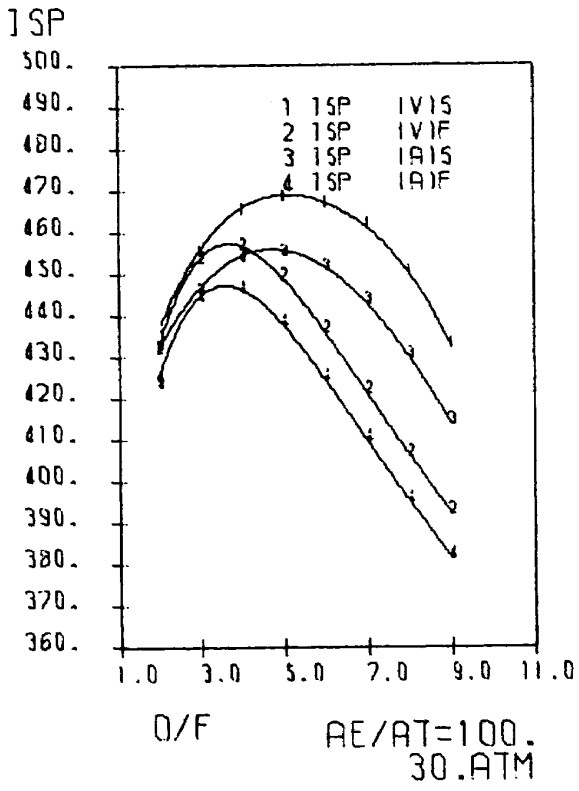


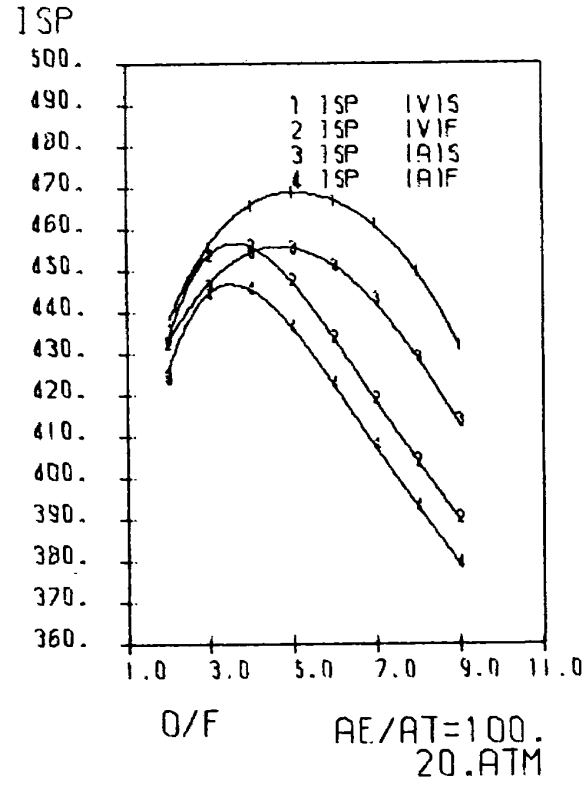


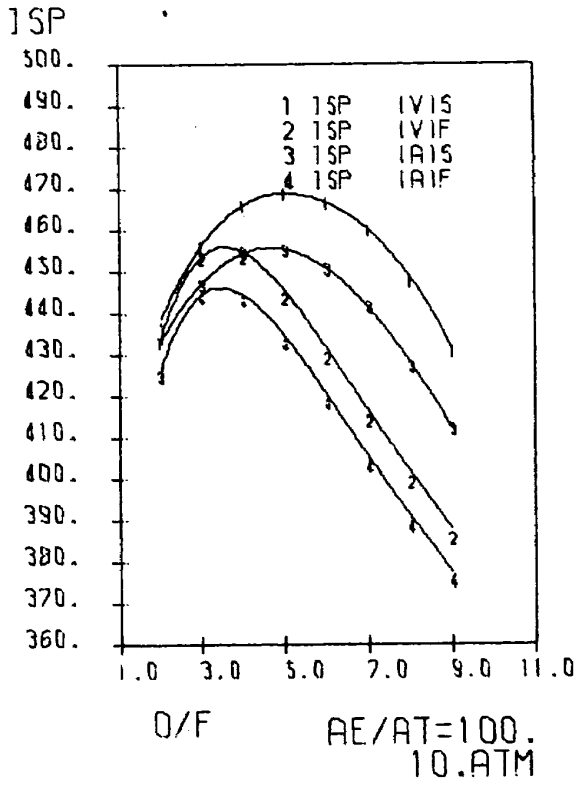
図B 2—13

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



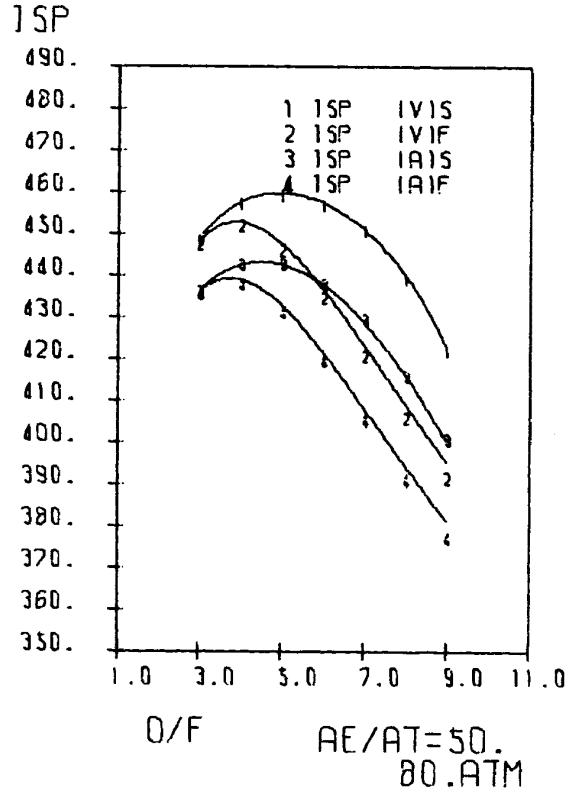


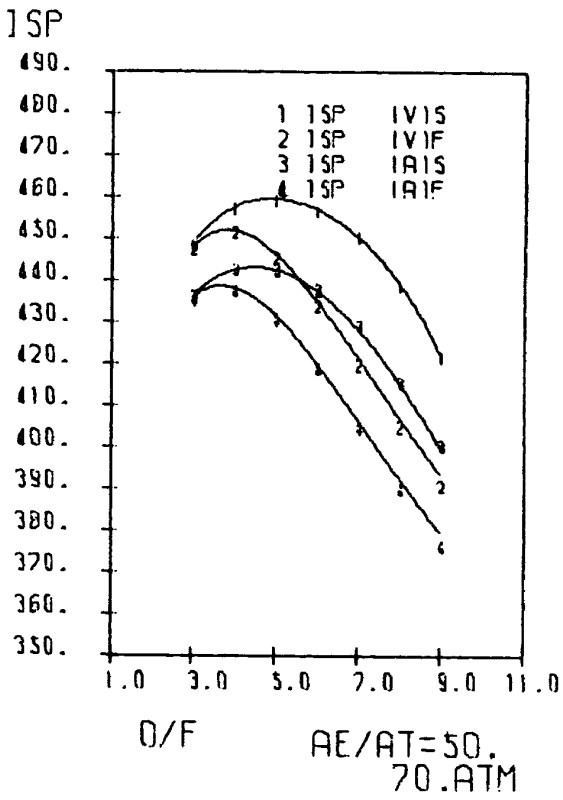


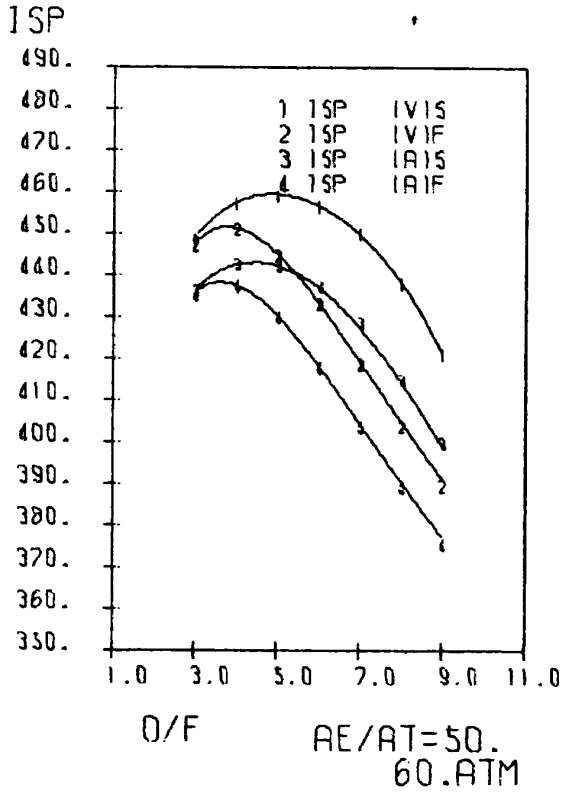


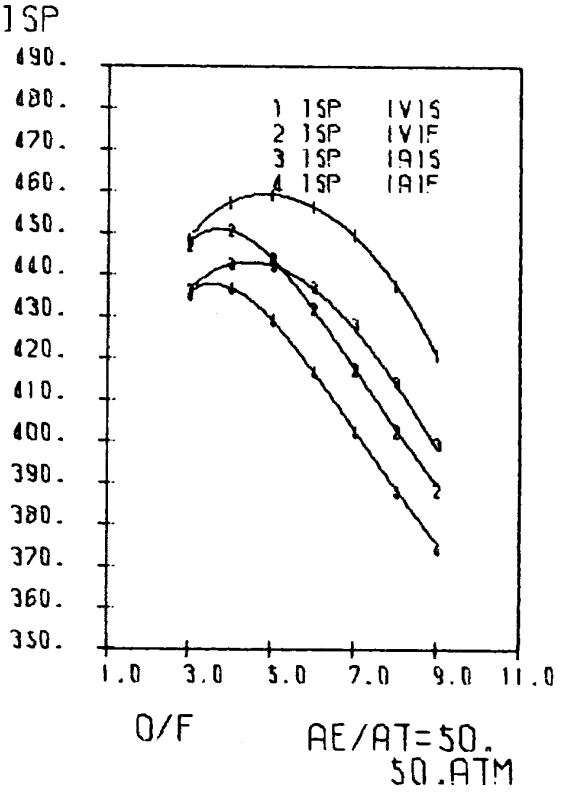
図B 2−14

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



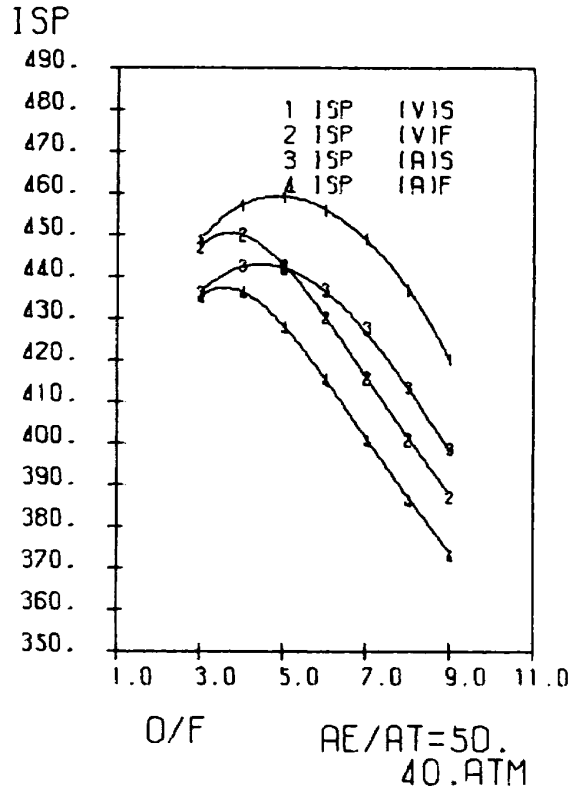


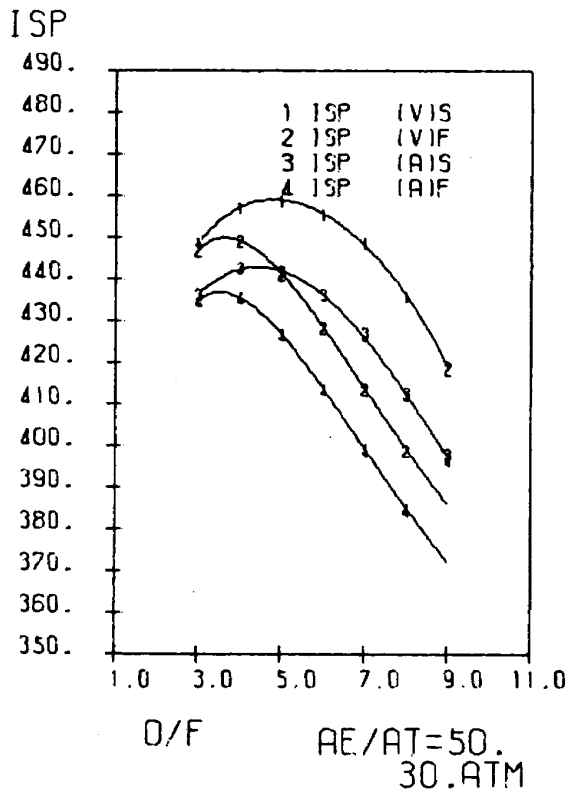


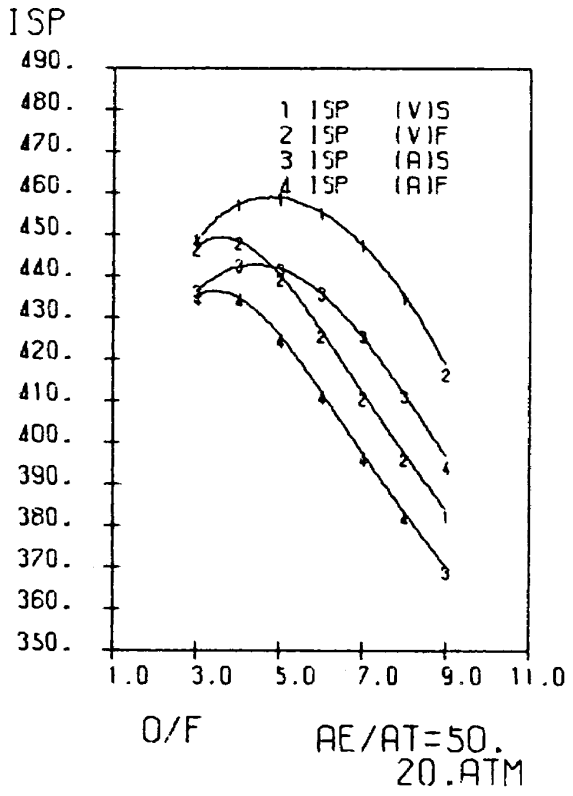


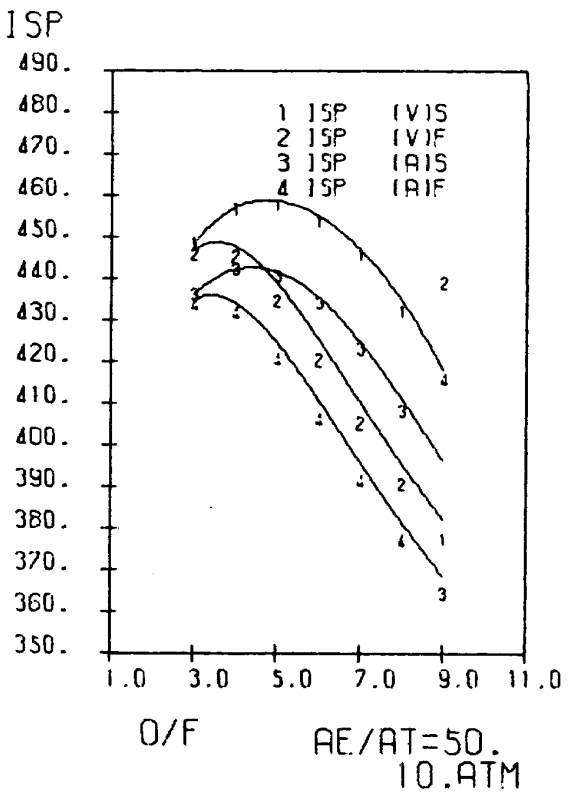
図B 3－1

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490



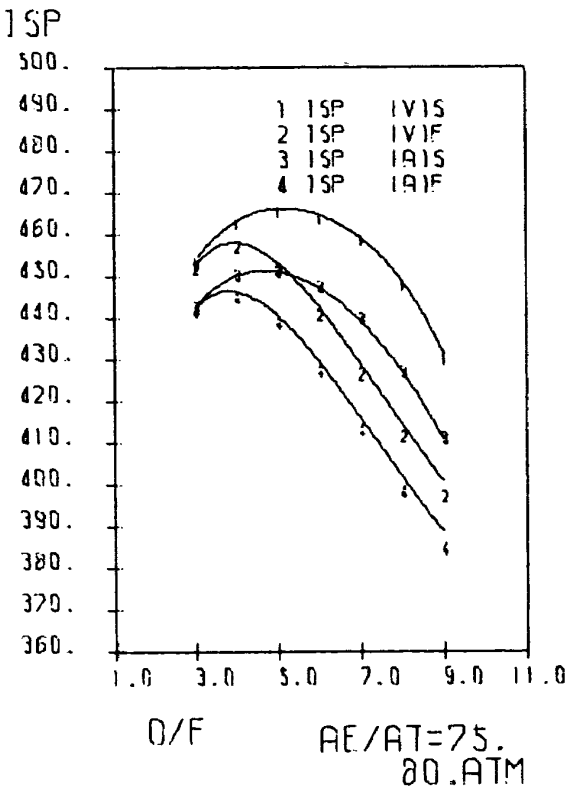


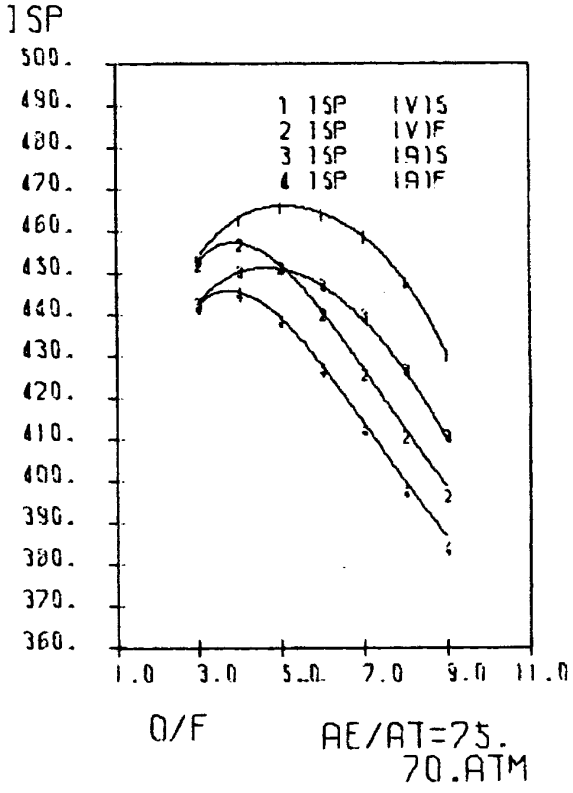


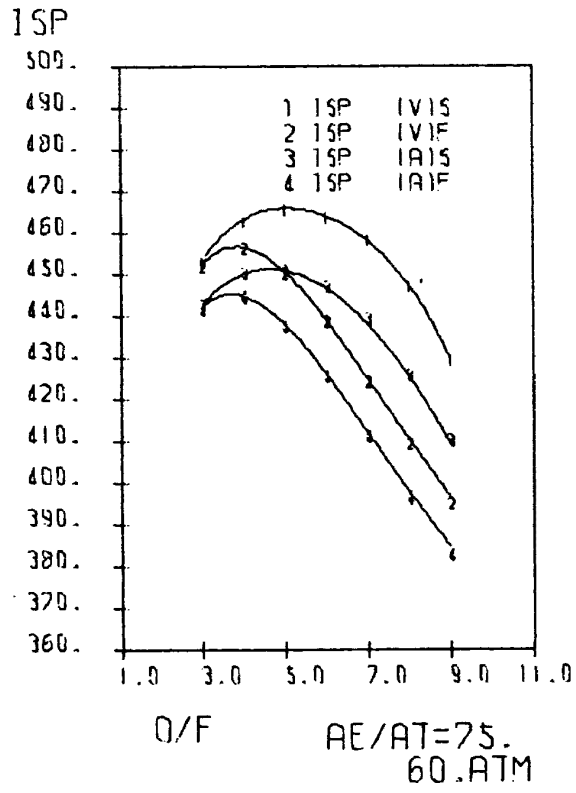


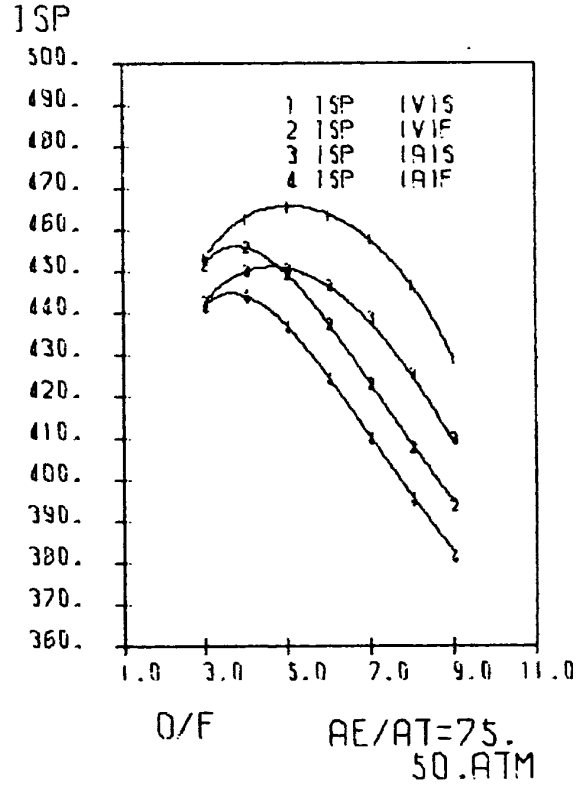
図B 3－2

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



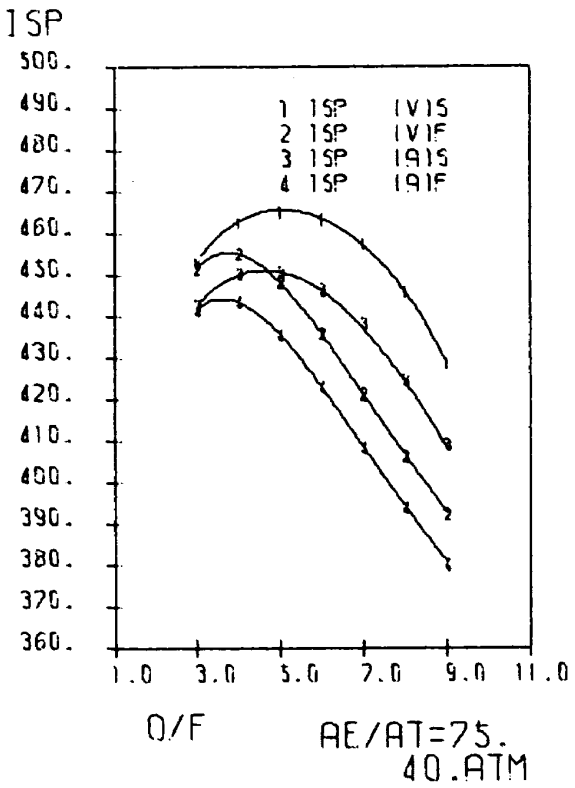


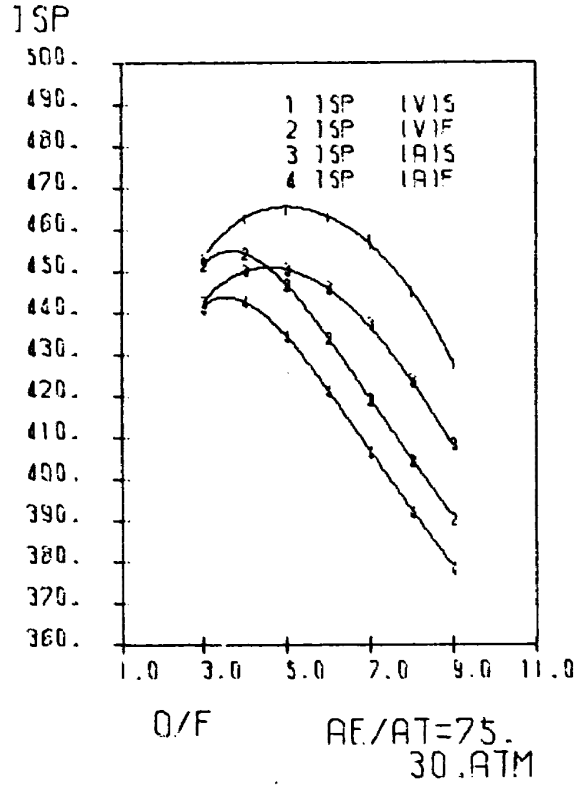


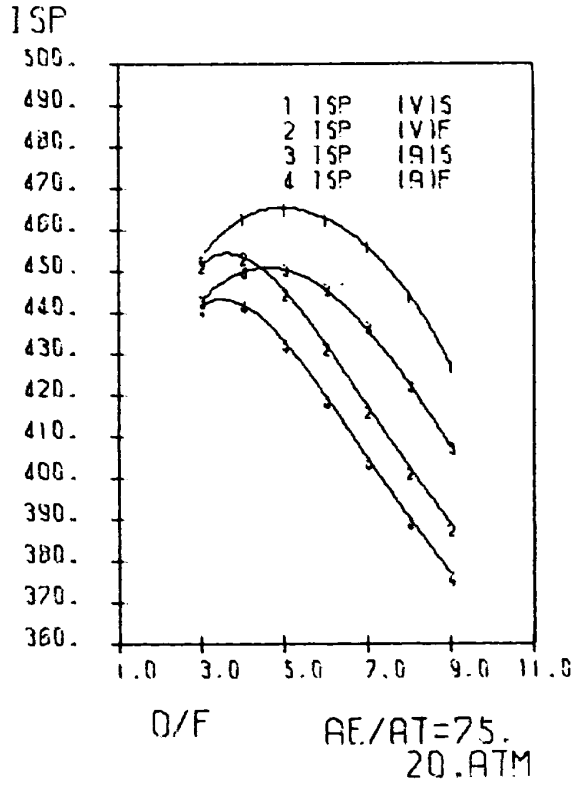


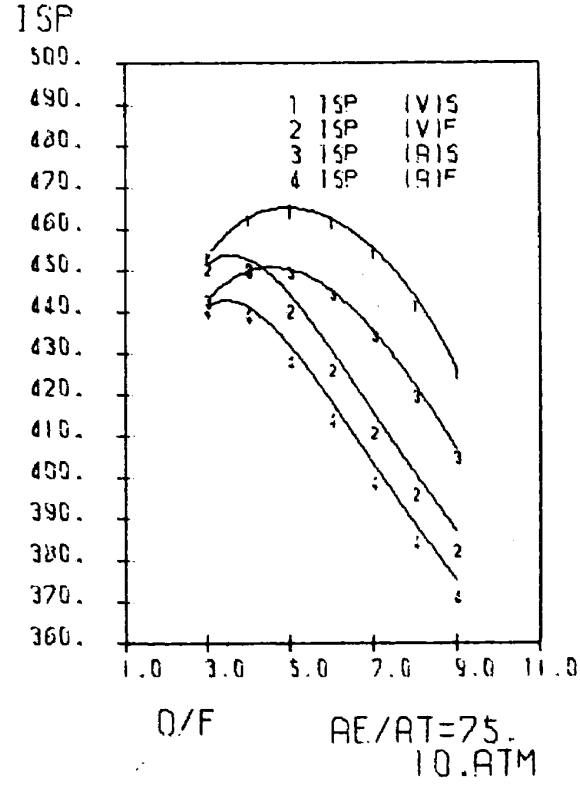
図B 3－3

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



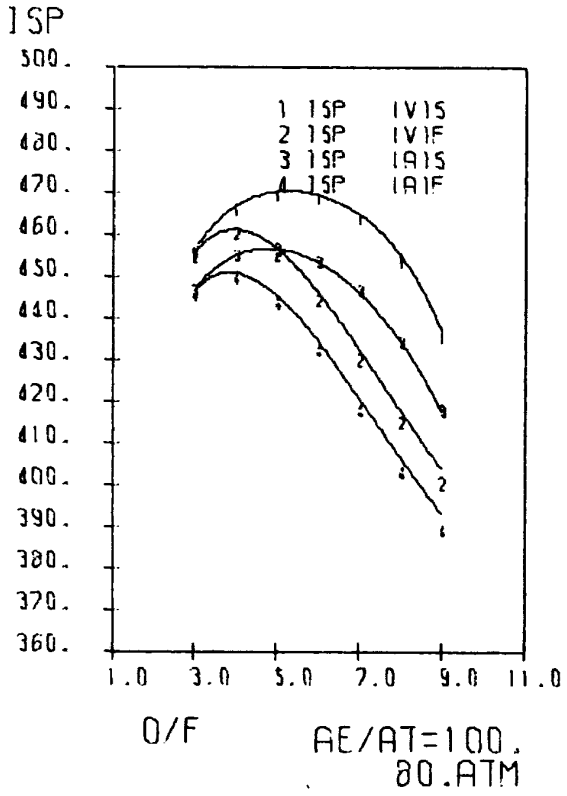


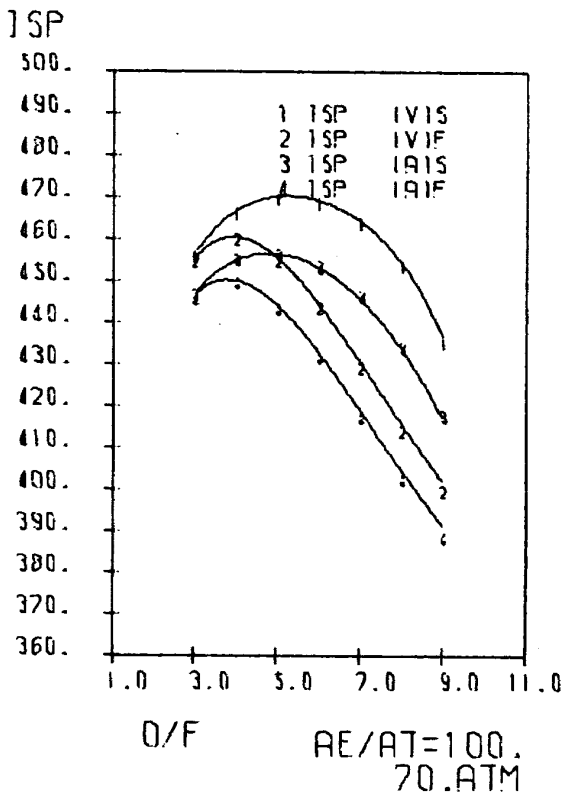


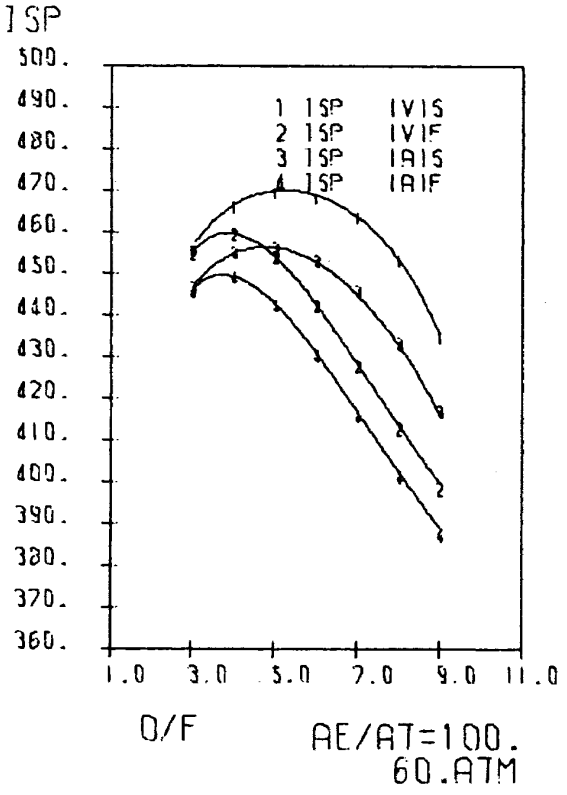


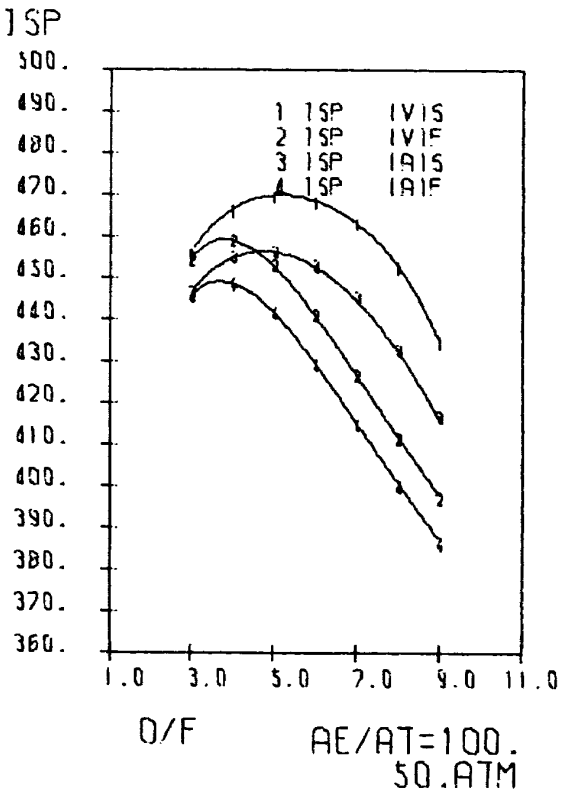
図B 3－4

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



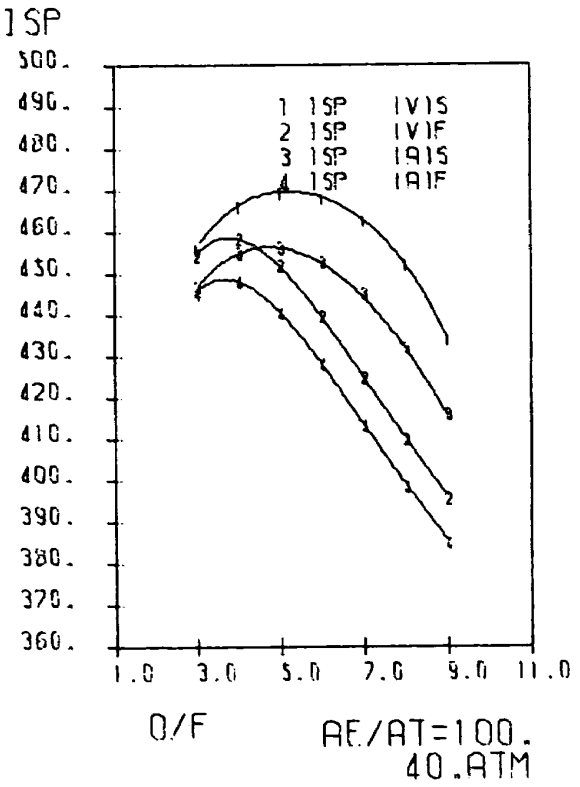


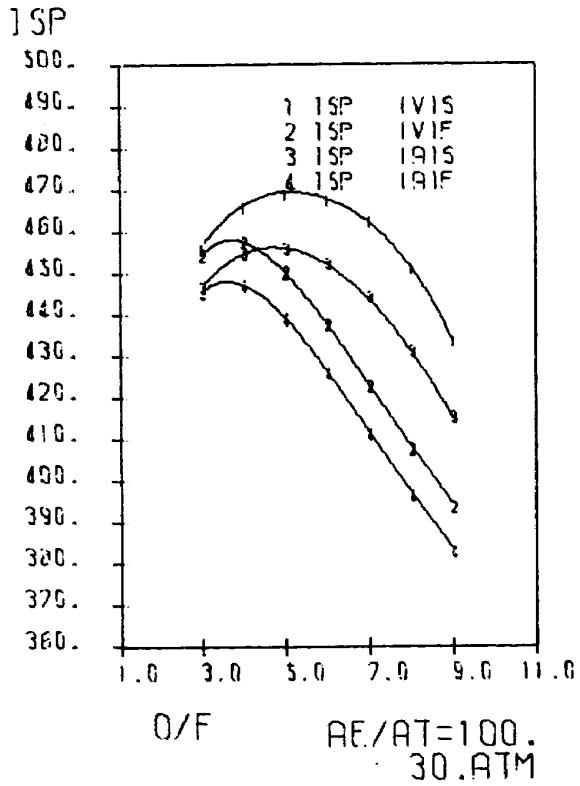


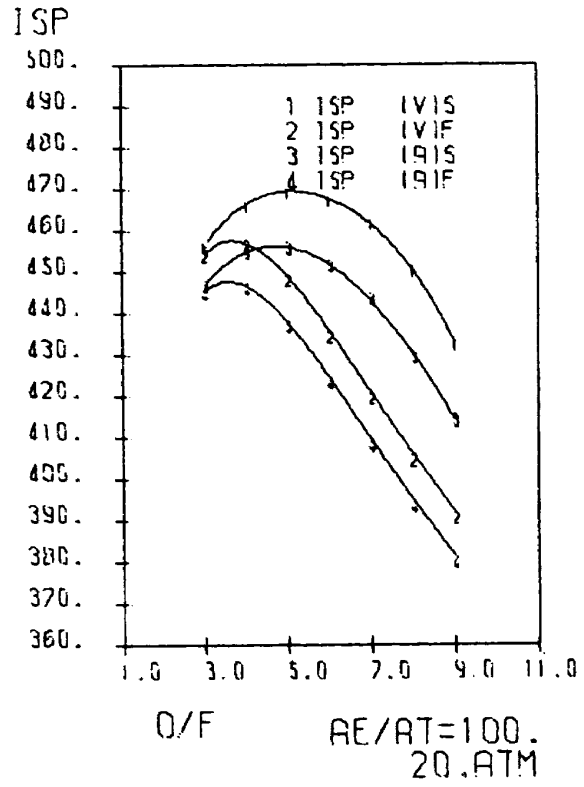


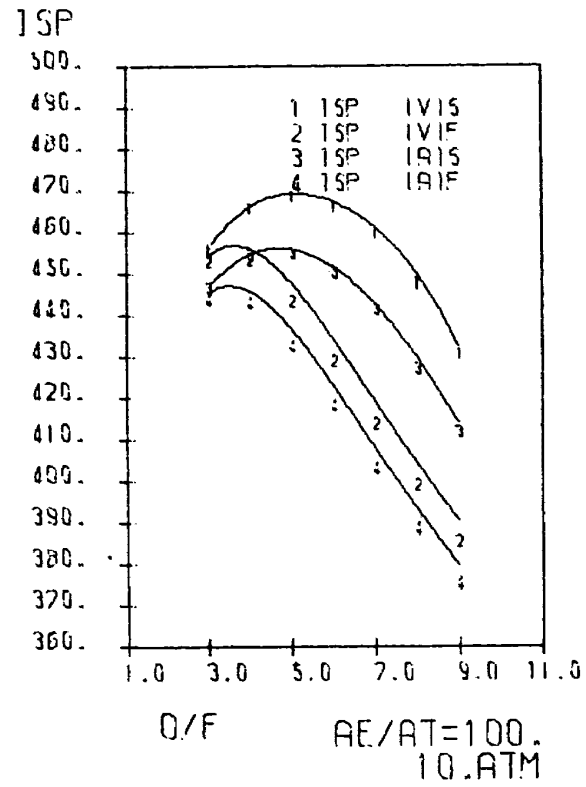
図B 3－5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



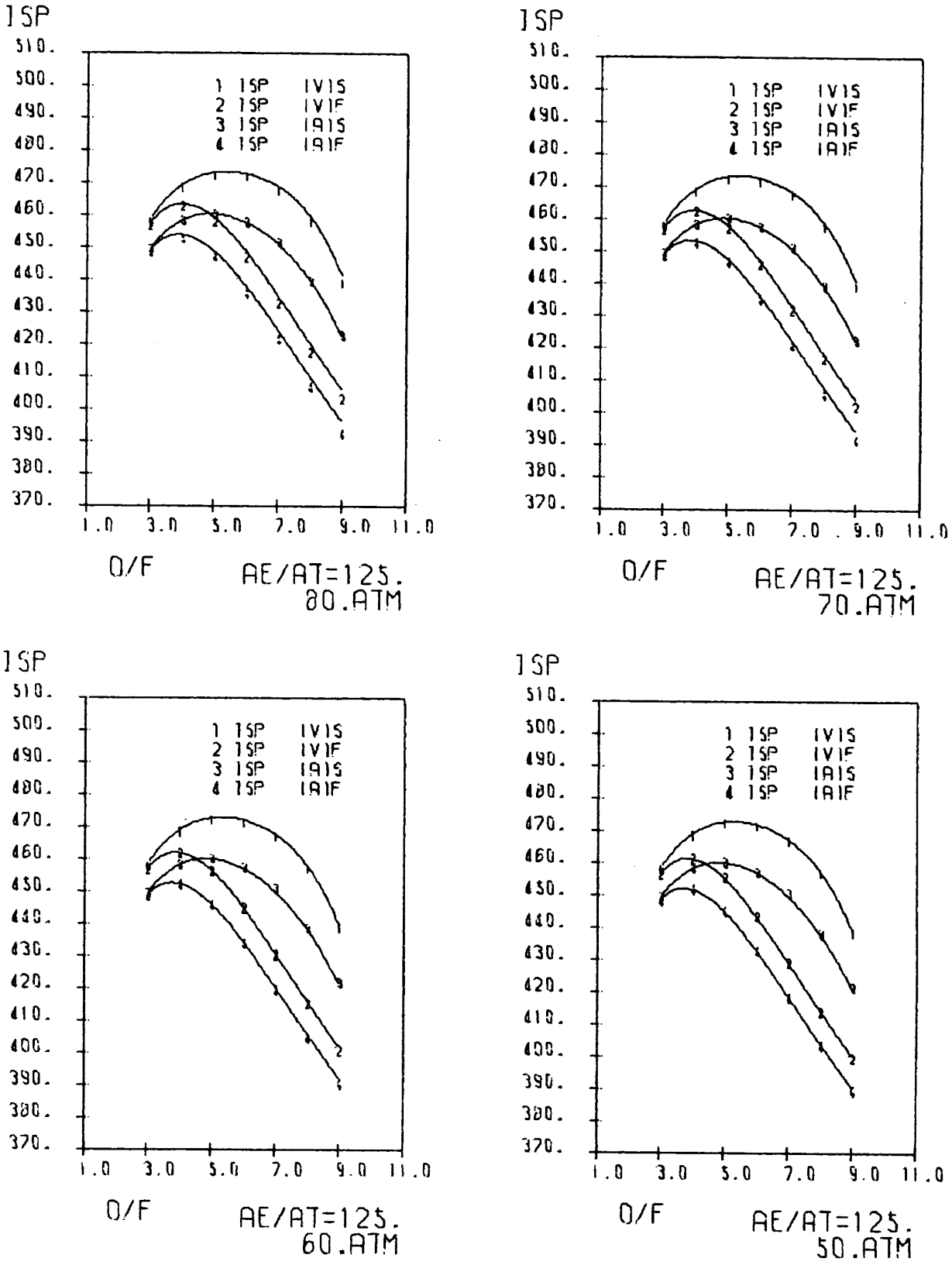






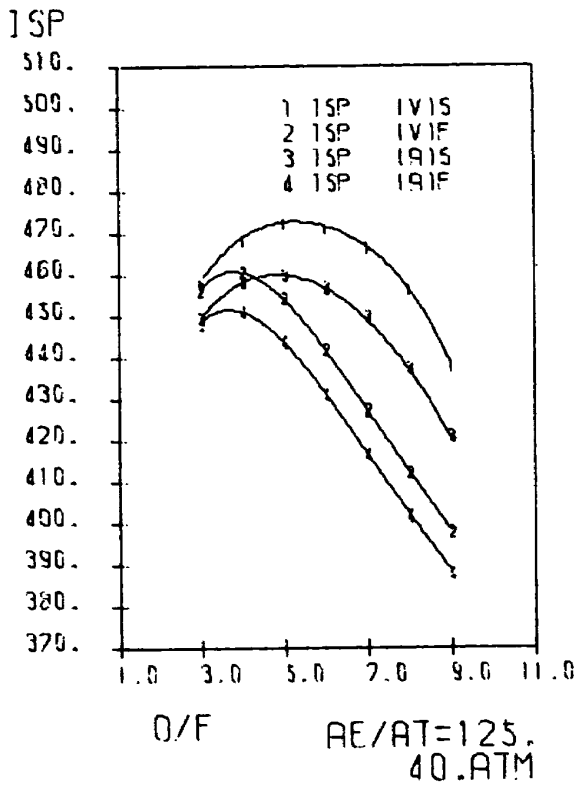
図B 3－6

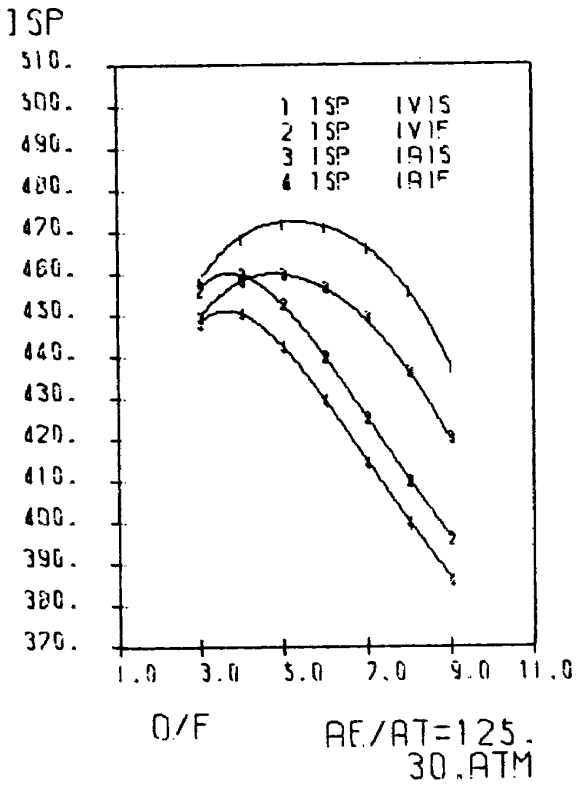
CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2134.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490

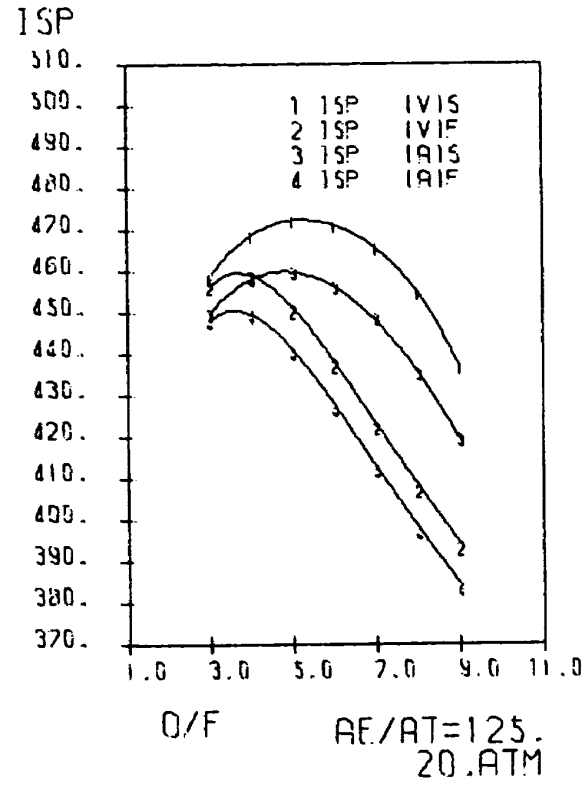


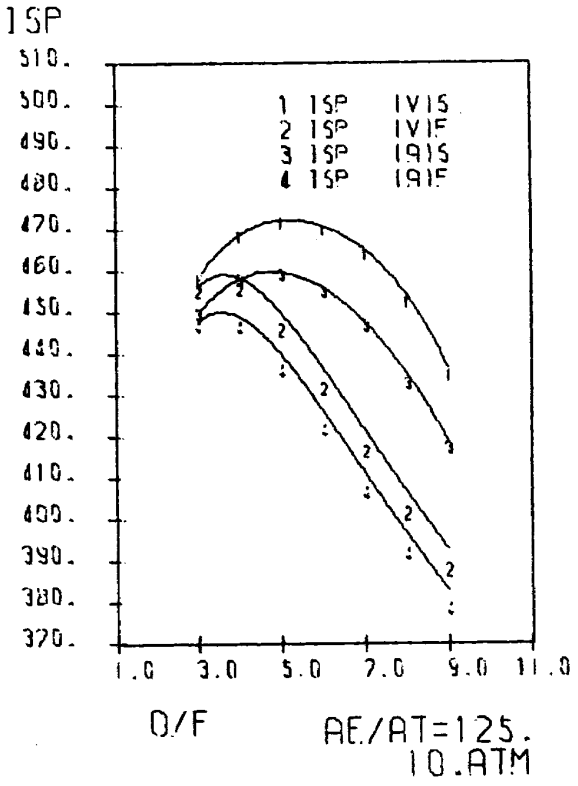
図B 3－7

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



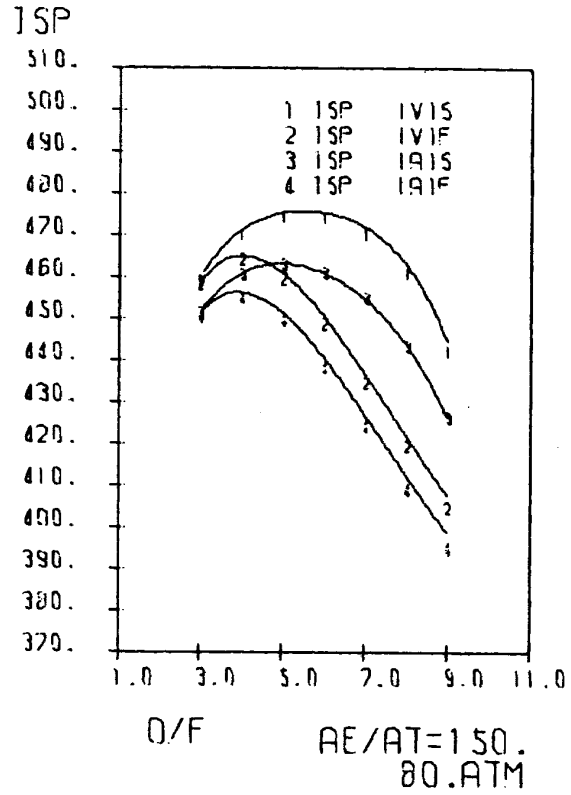


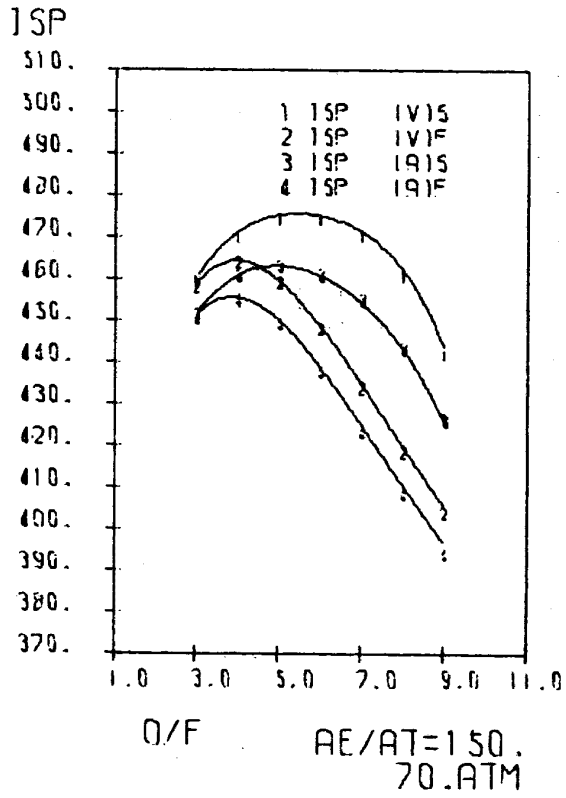


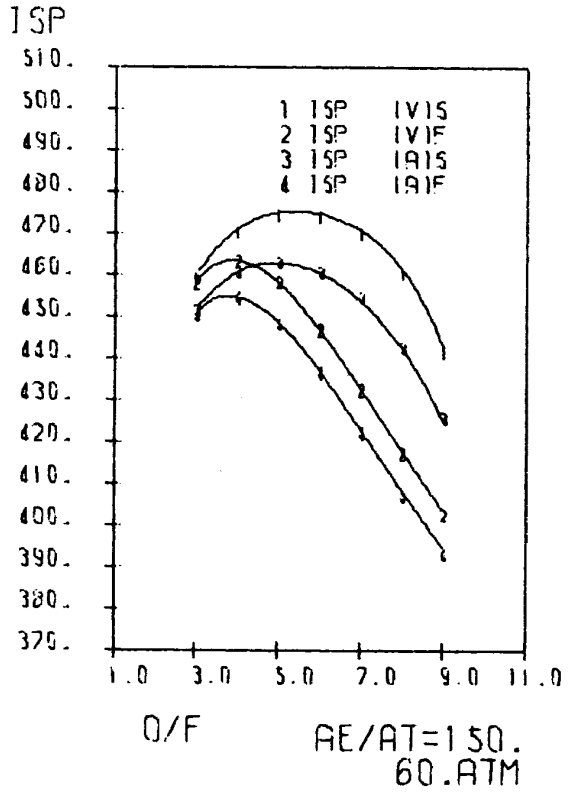


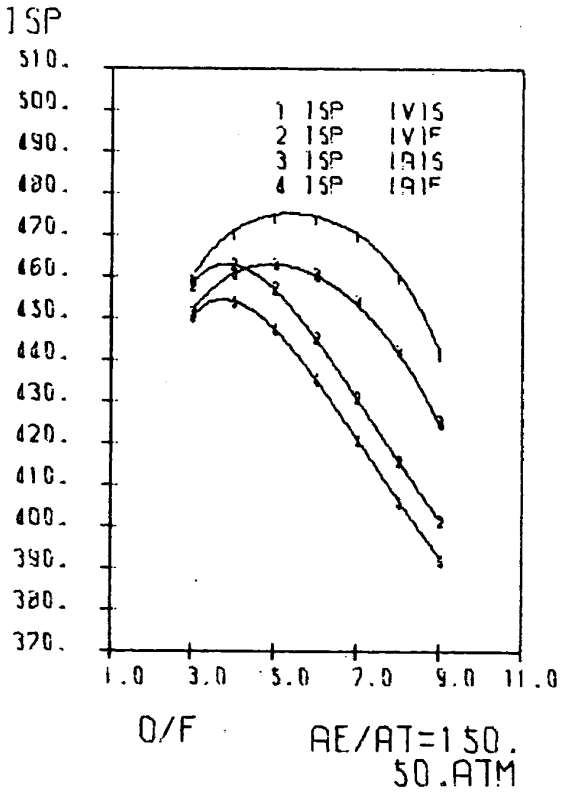
図B 3－8

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490



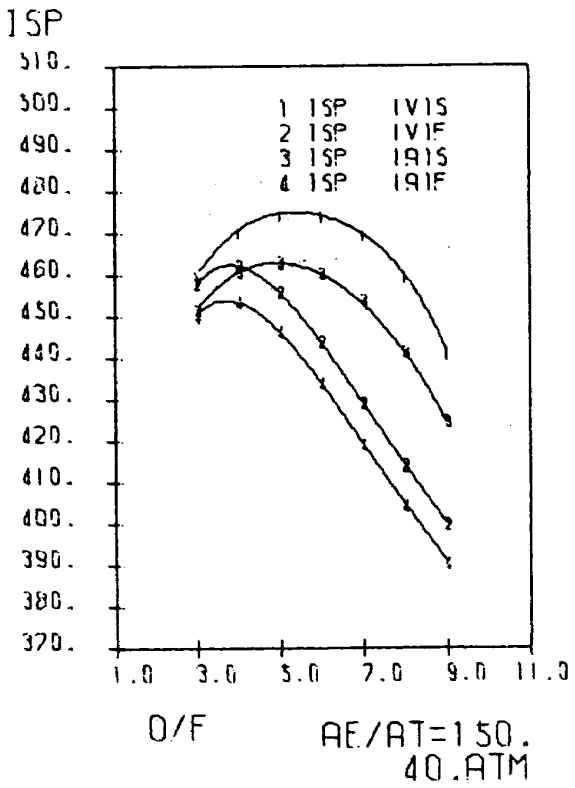


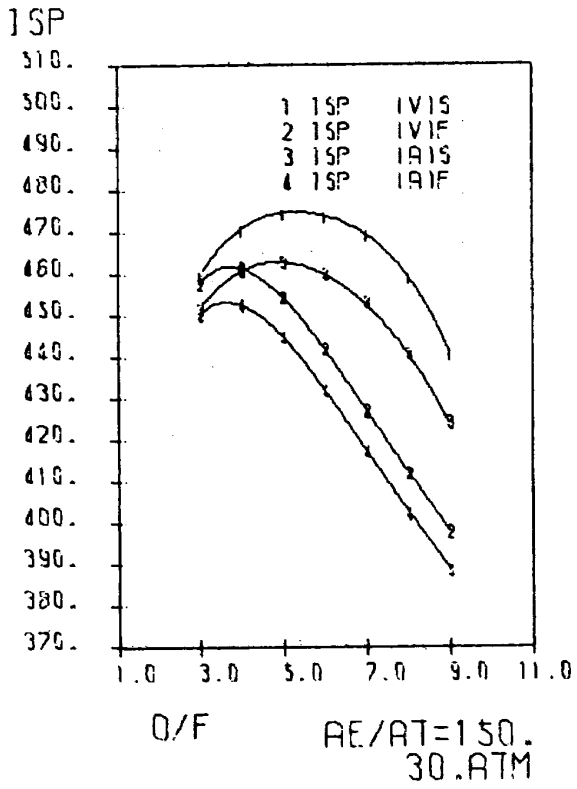


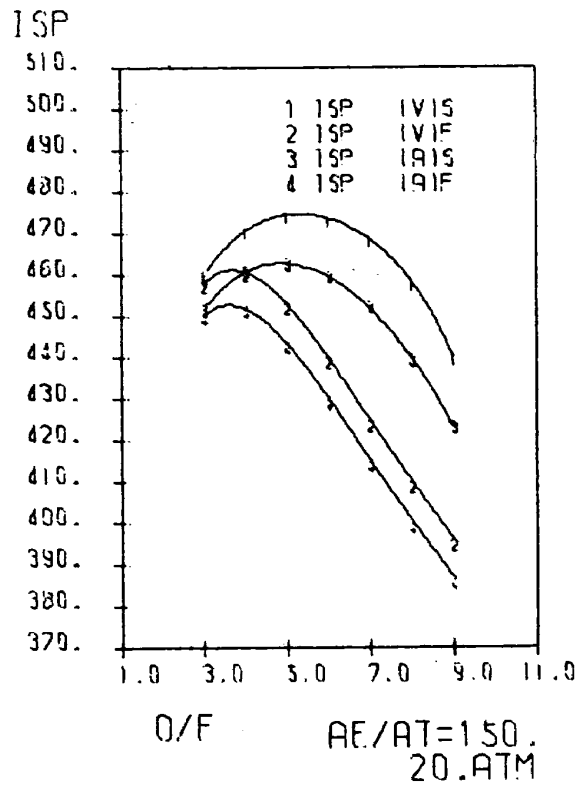


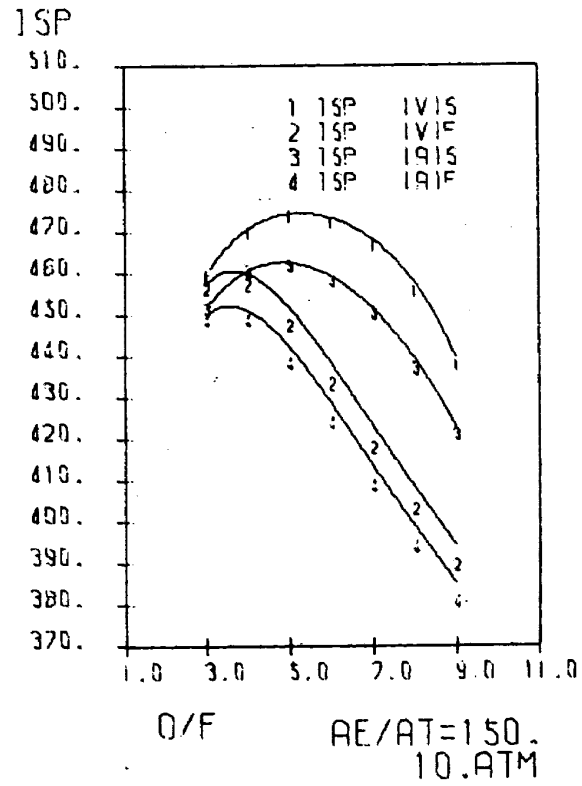
図B 3－9

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



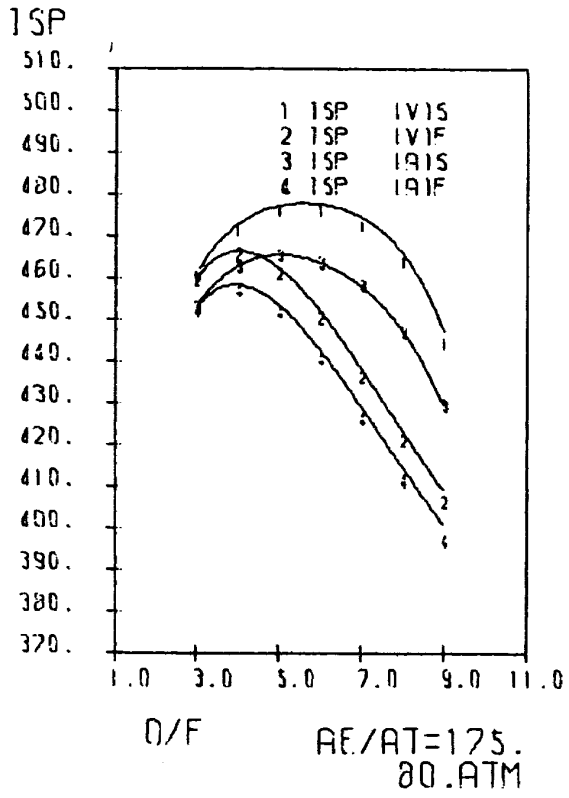


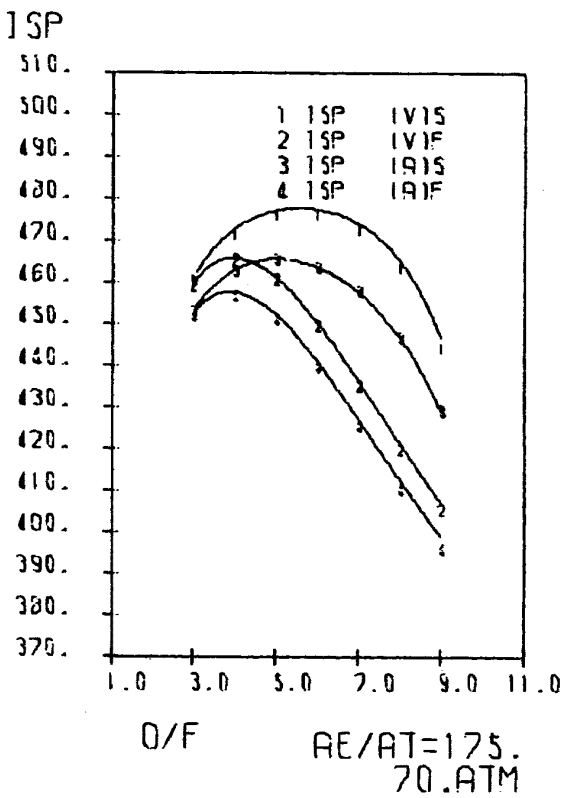


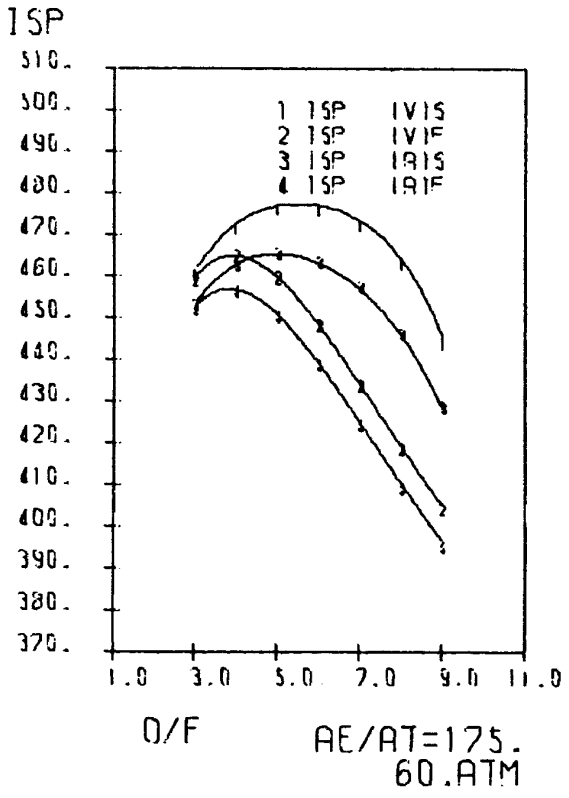


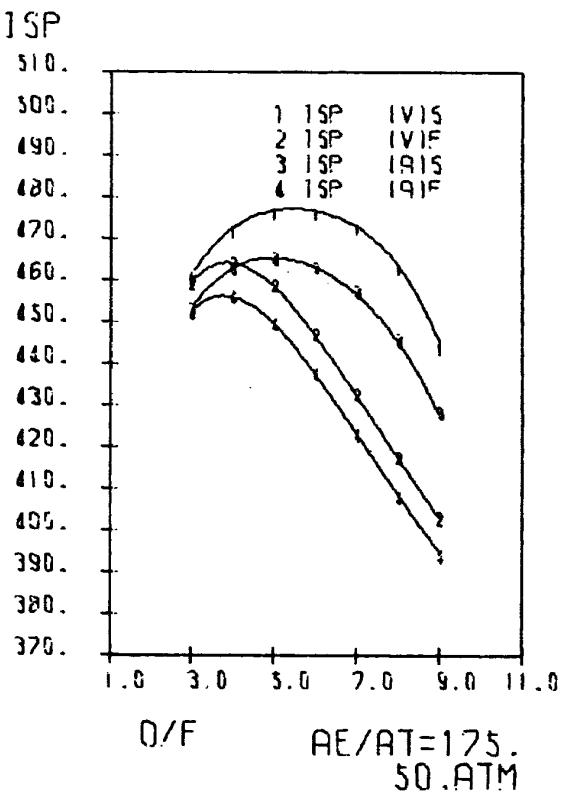
図B 3−10

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



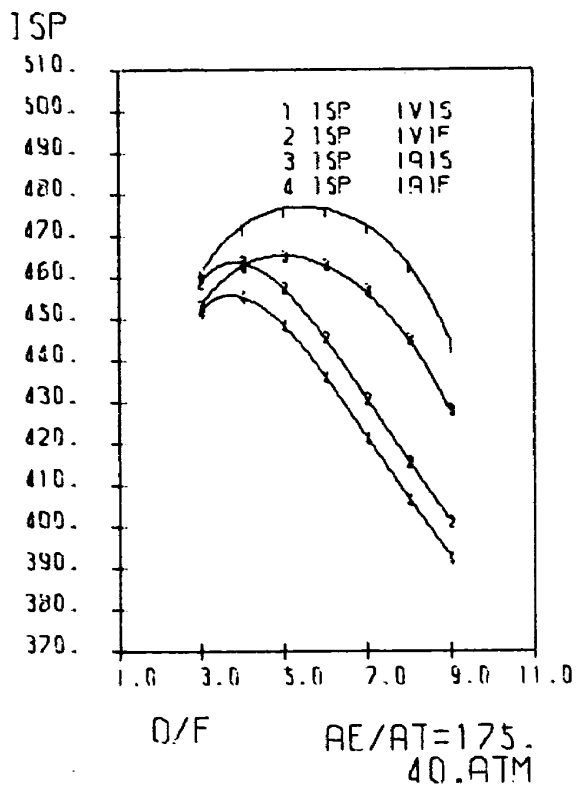


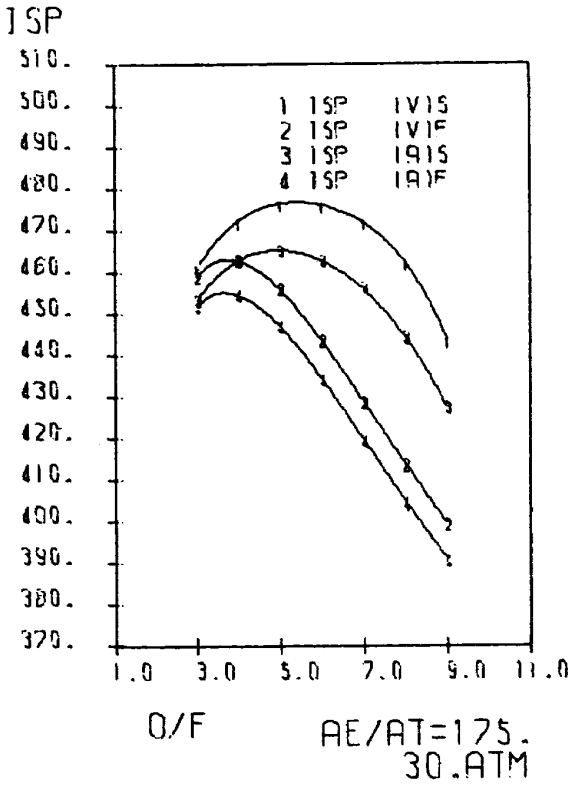


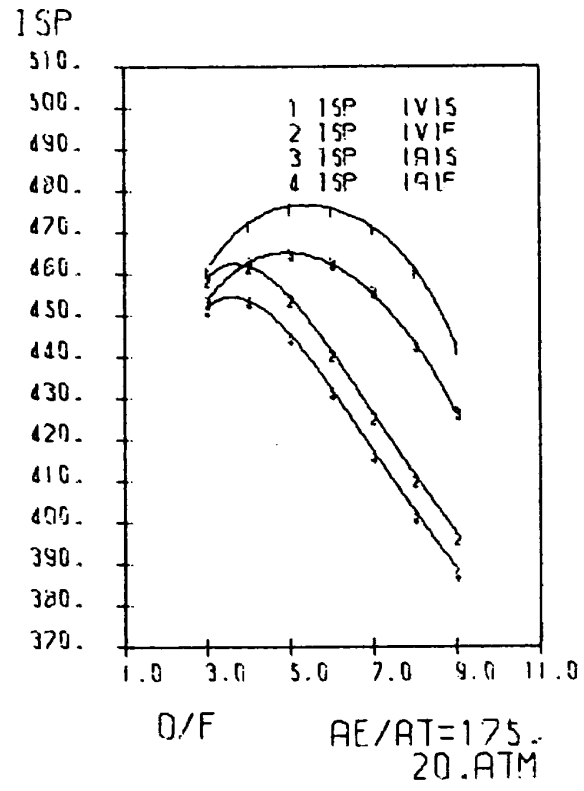


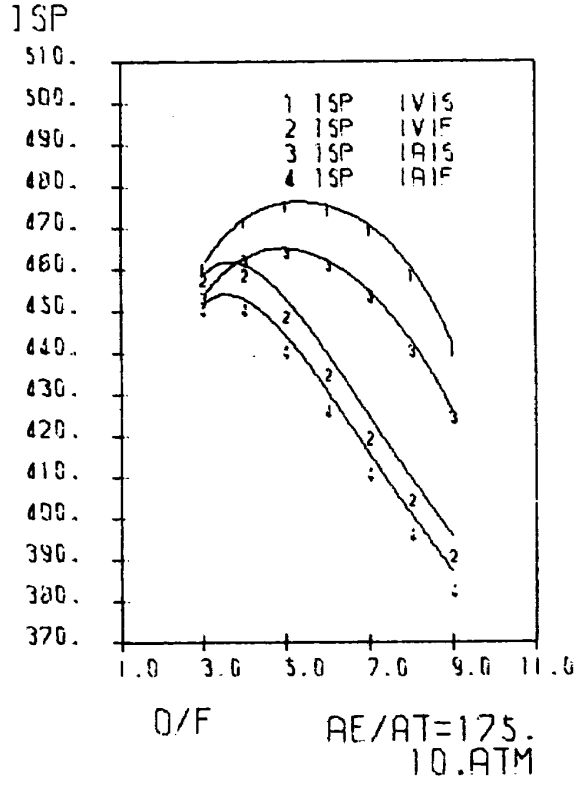
図B 3−11

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



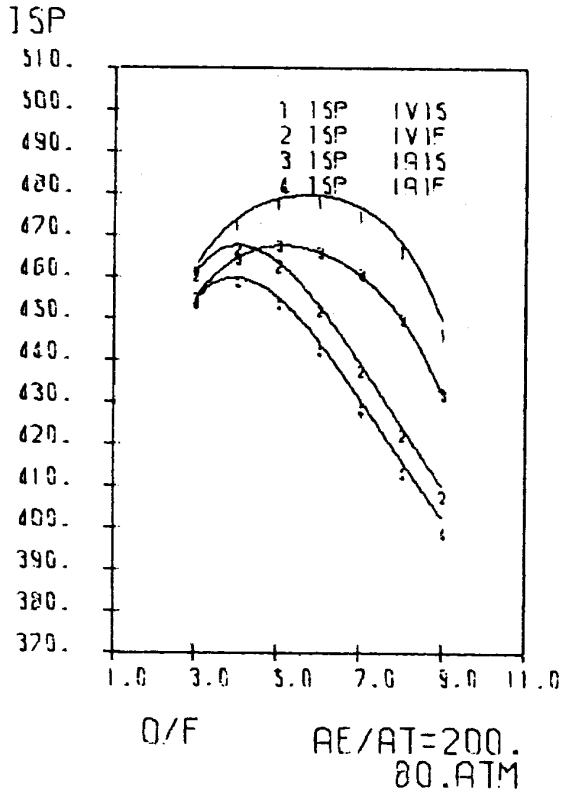


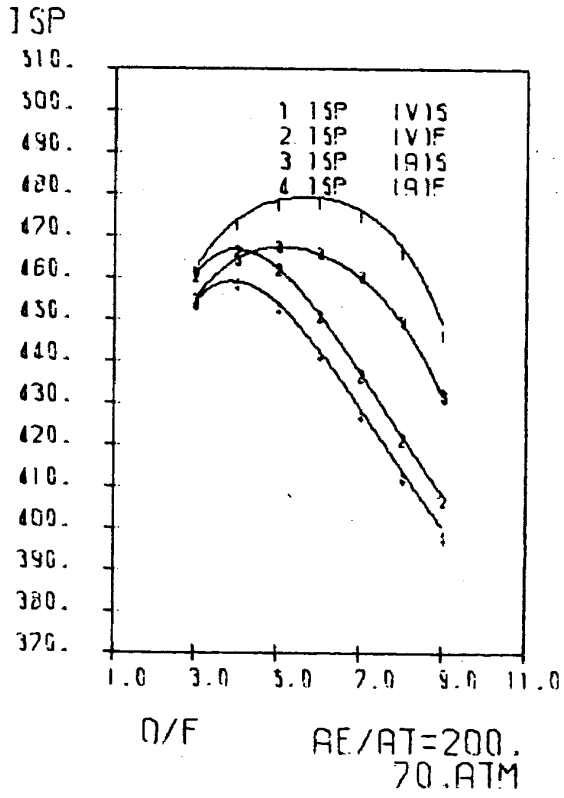


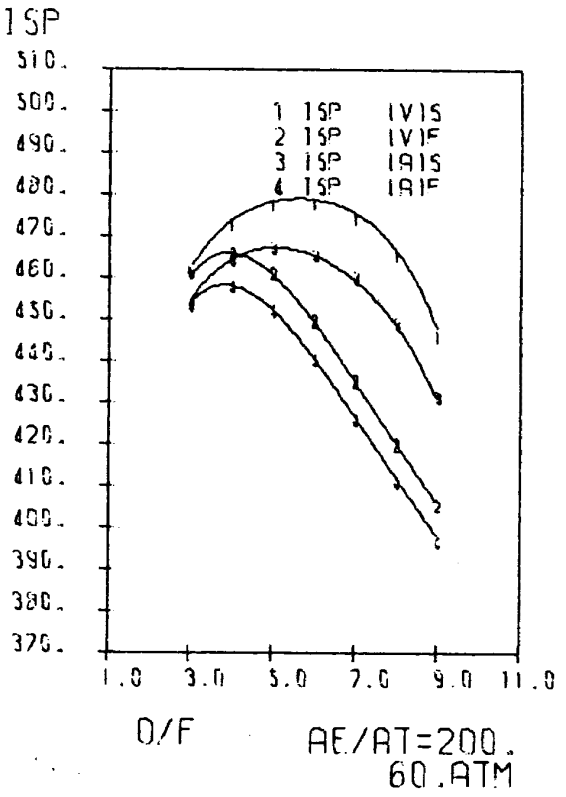


図B 3−12

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.10	O	1.1490







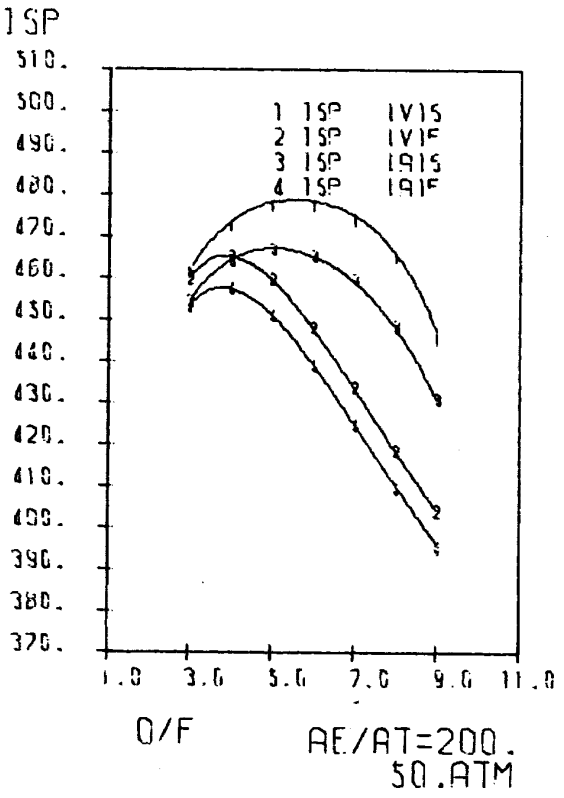
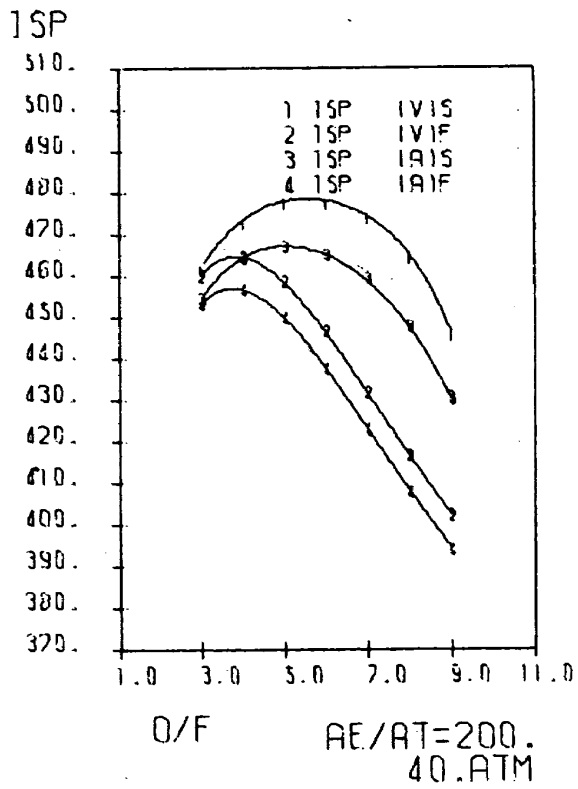
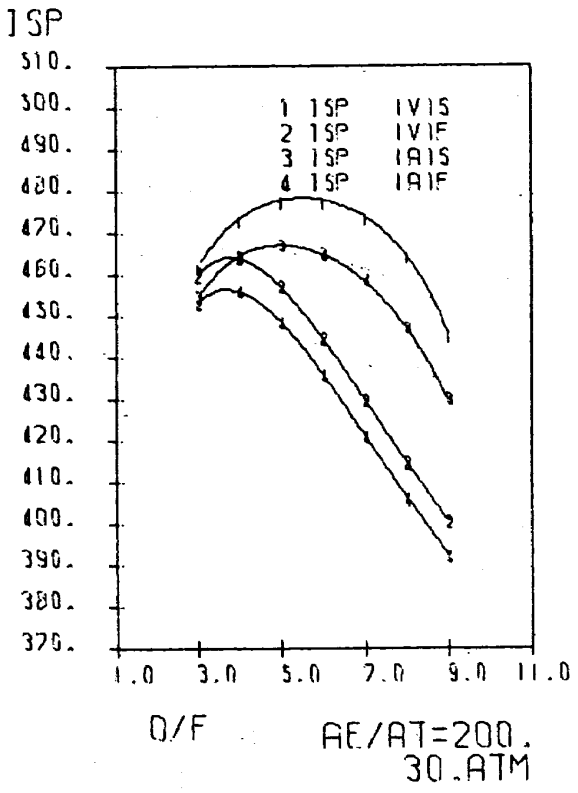
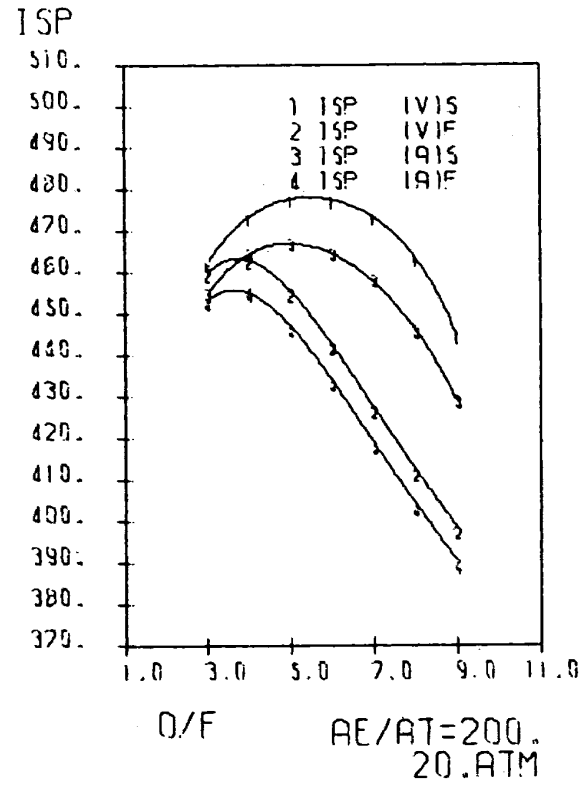


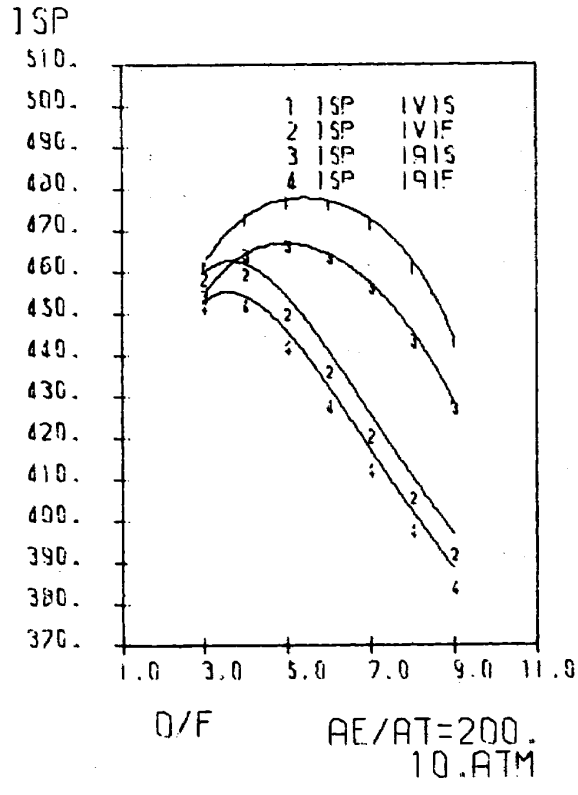
図 B 3−13

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490



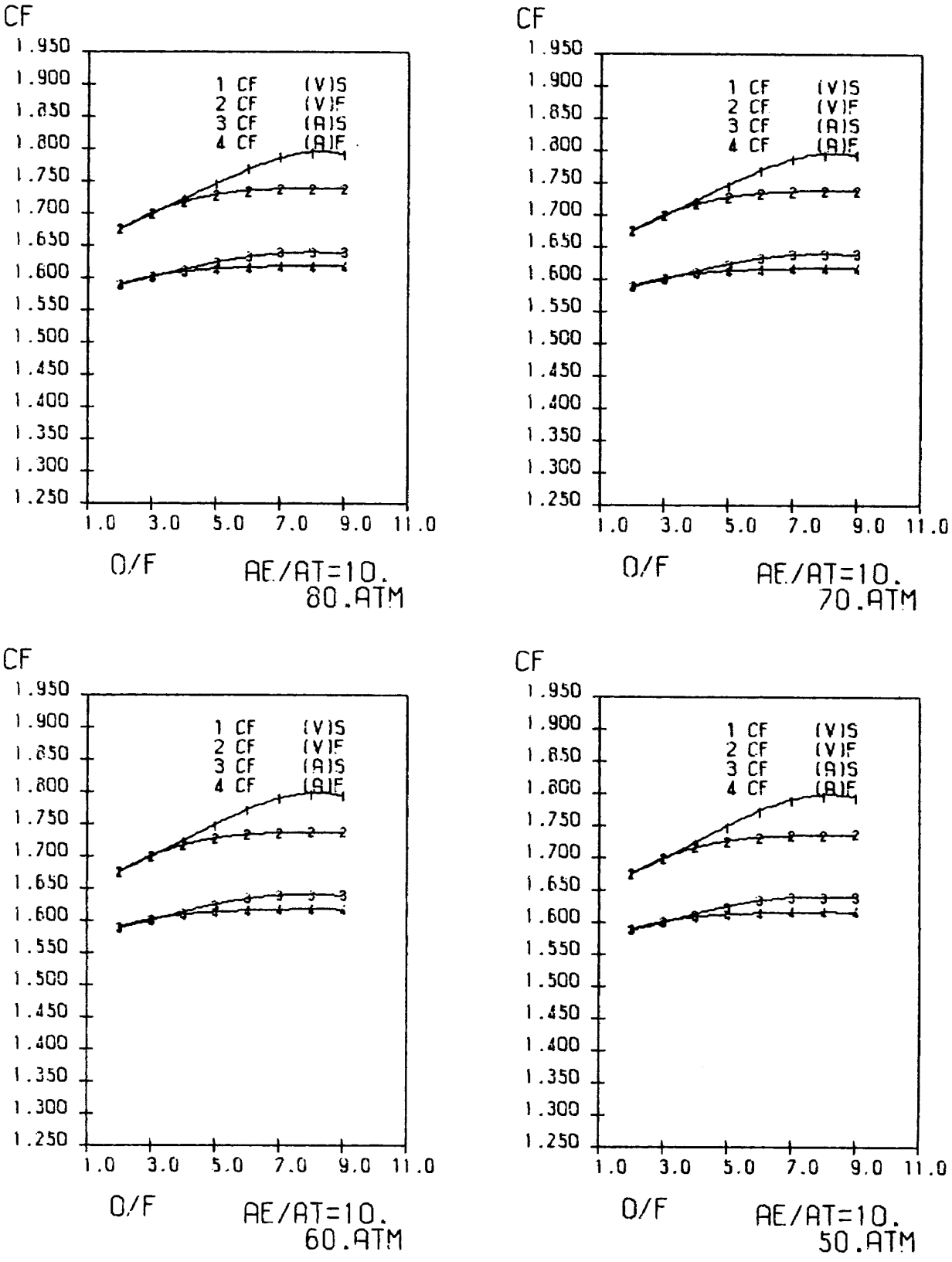






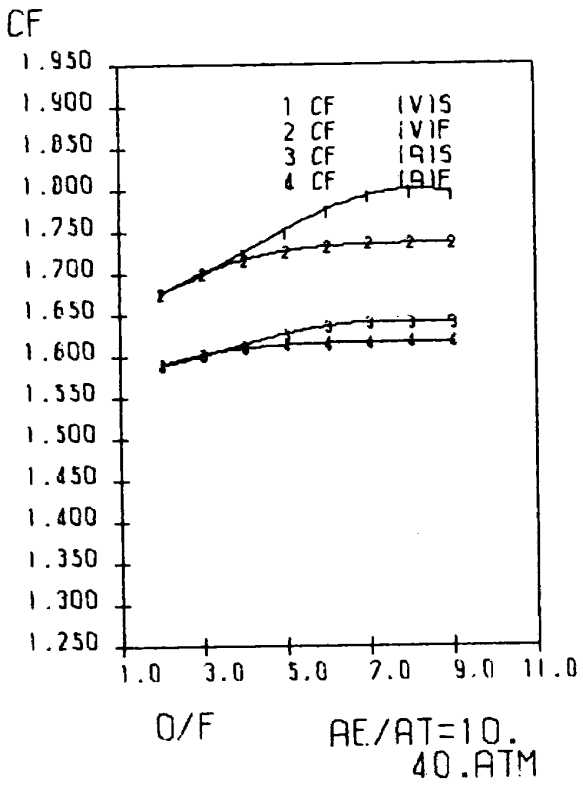
図B 3—14

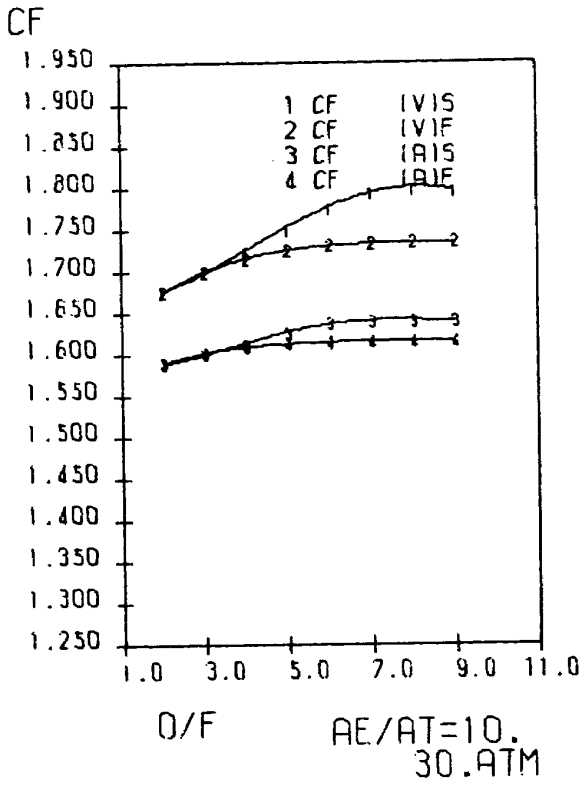
CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490

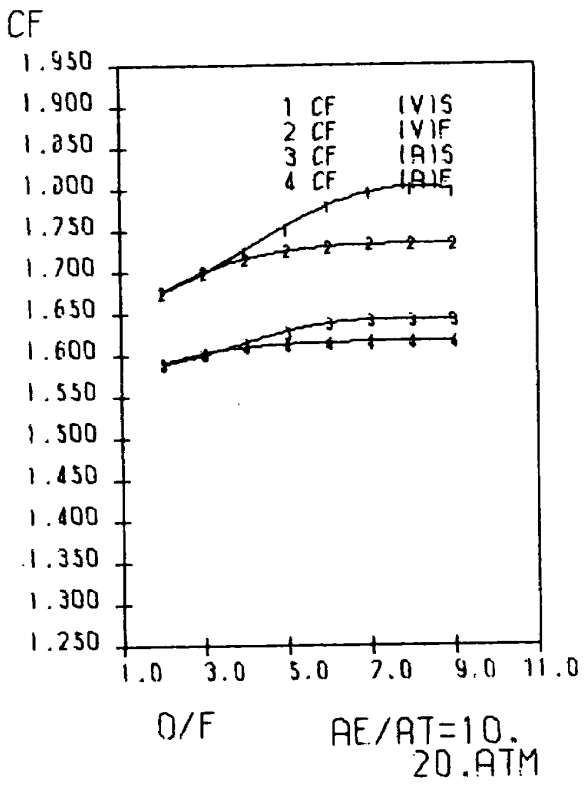


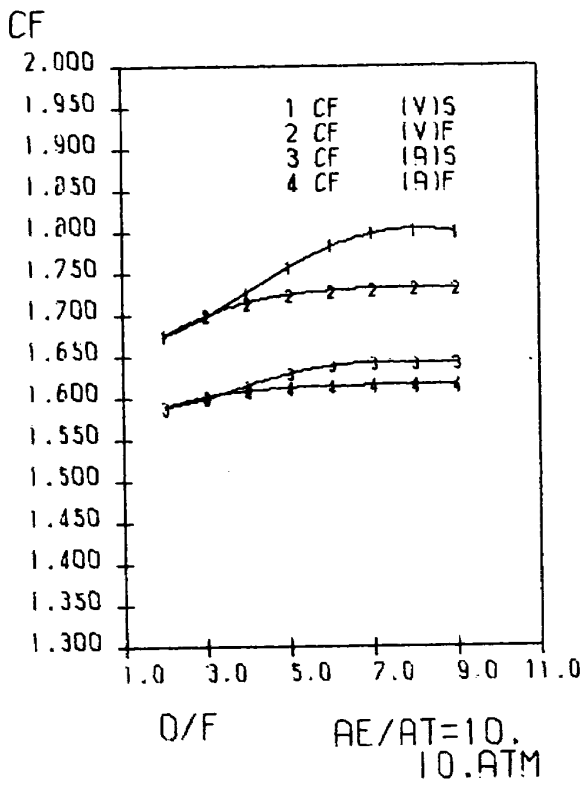
図B 4 − 1

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



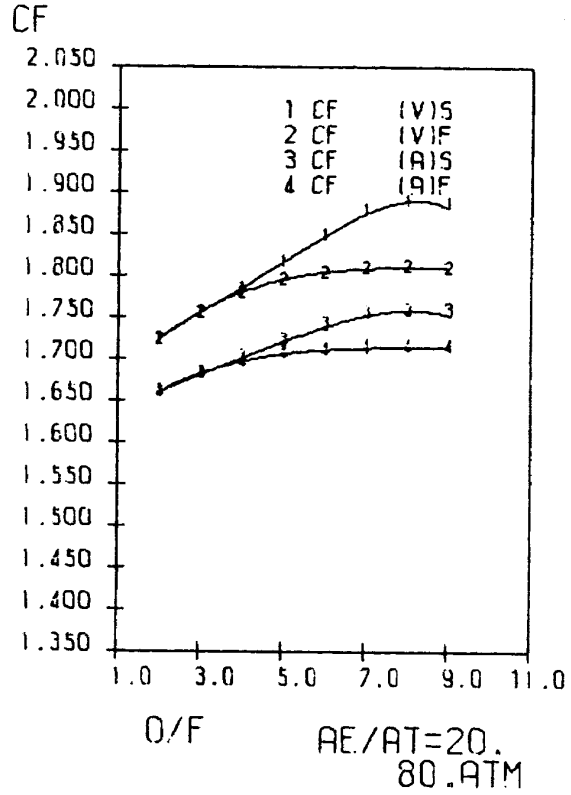


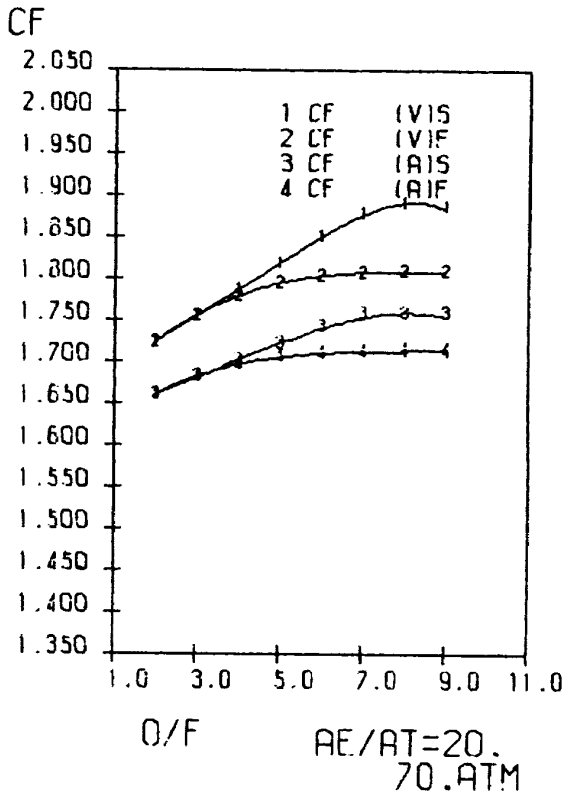


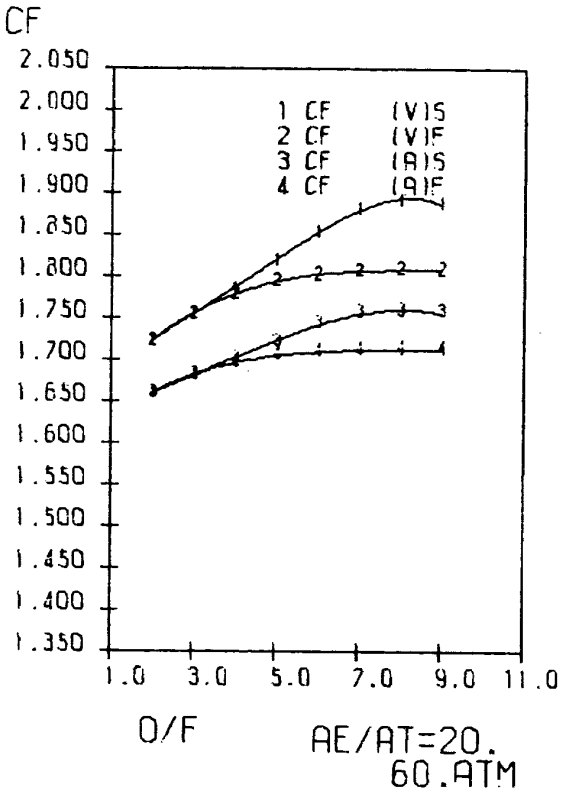


図B 4 − 2

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







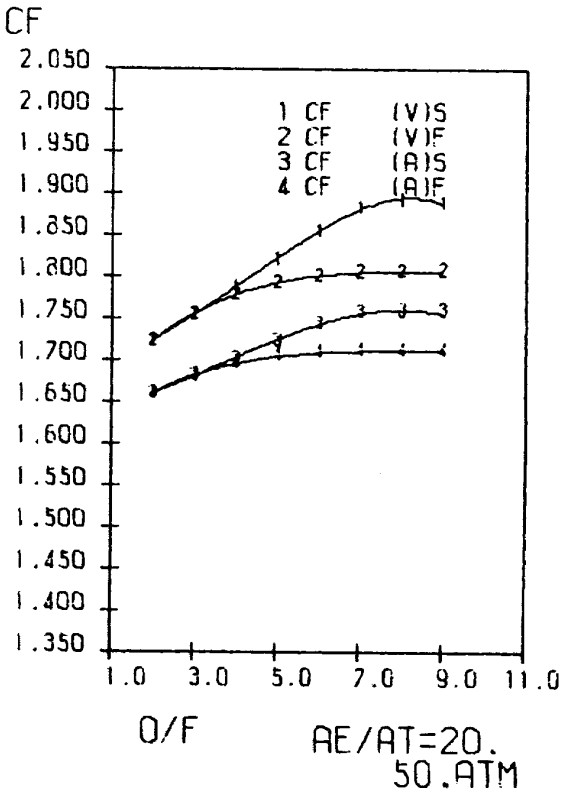
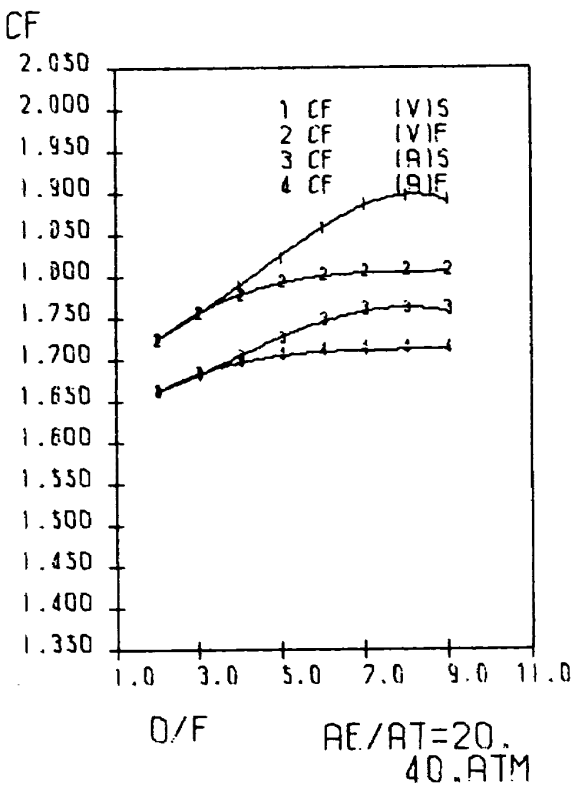
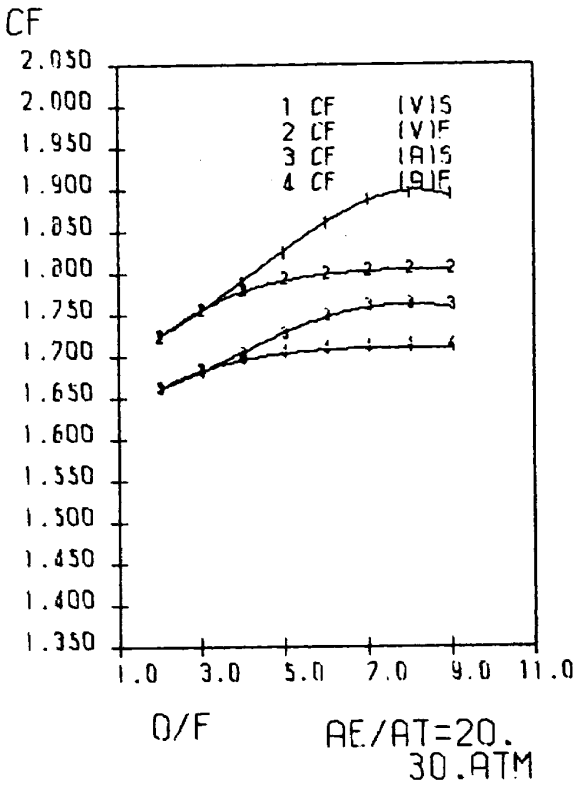
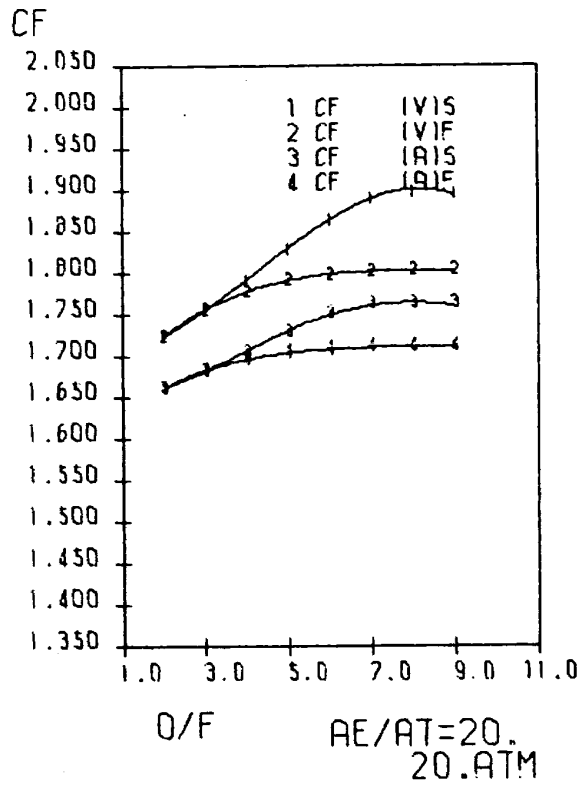


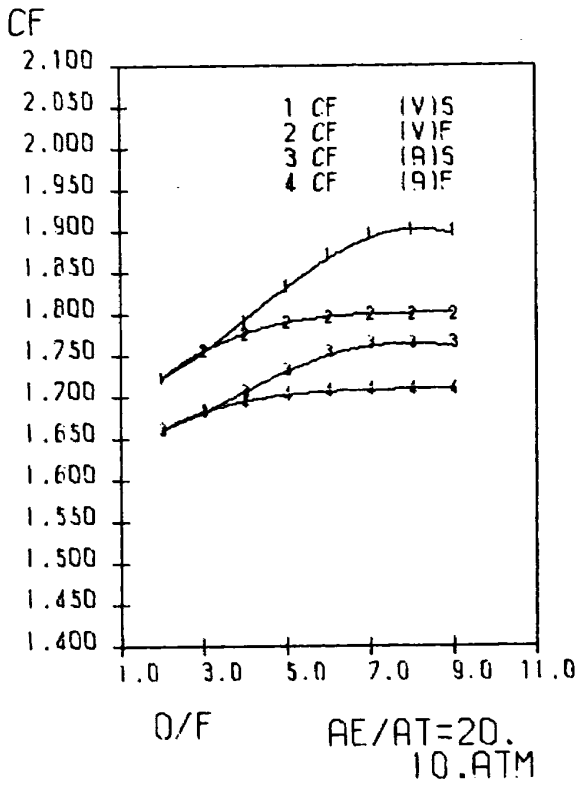
図 B 4 − 3

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



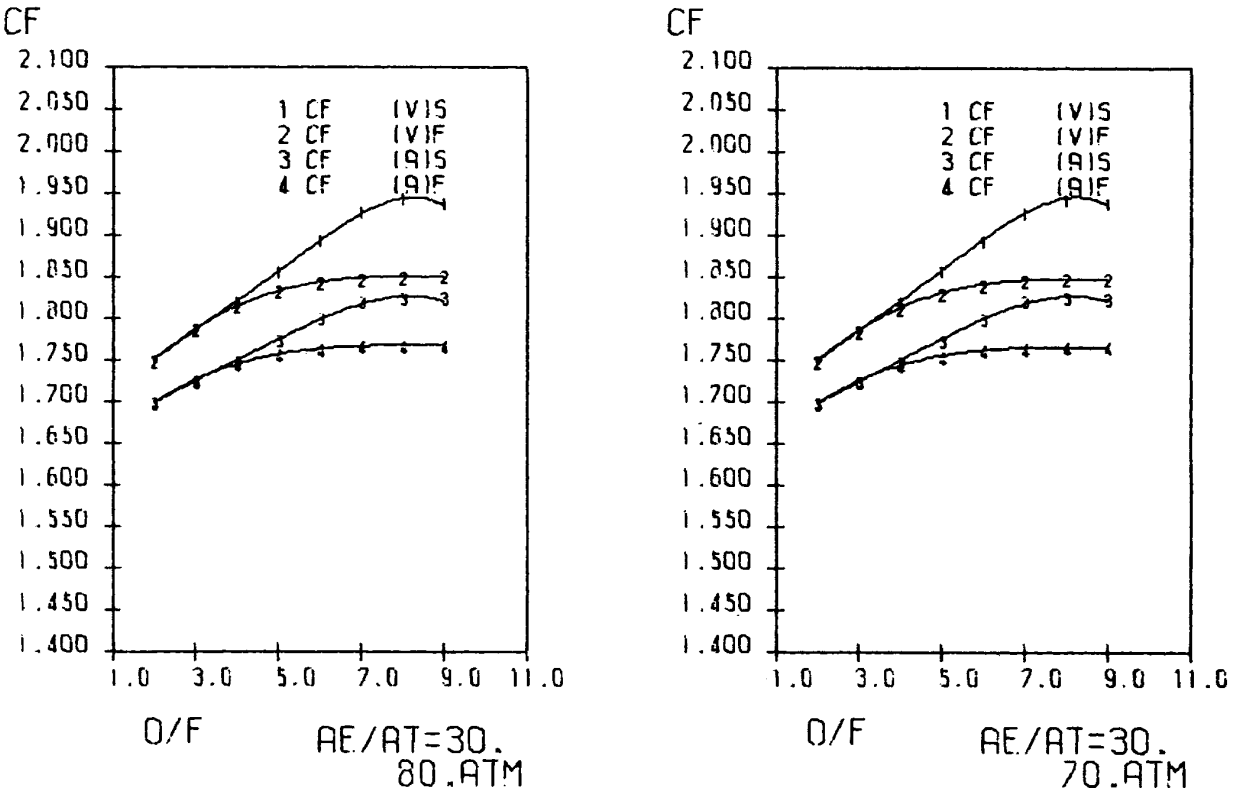


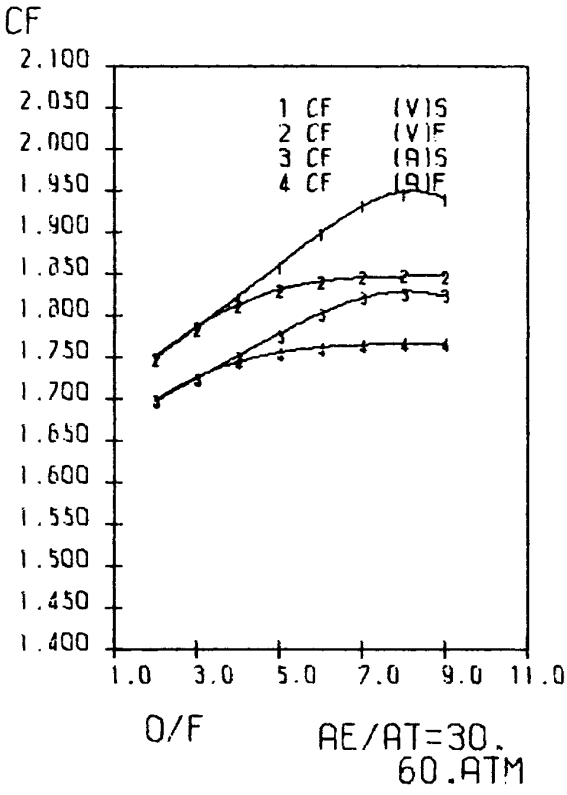




図B 4－4

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





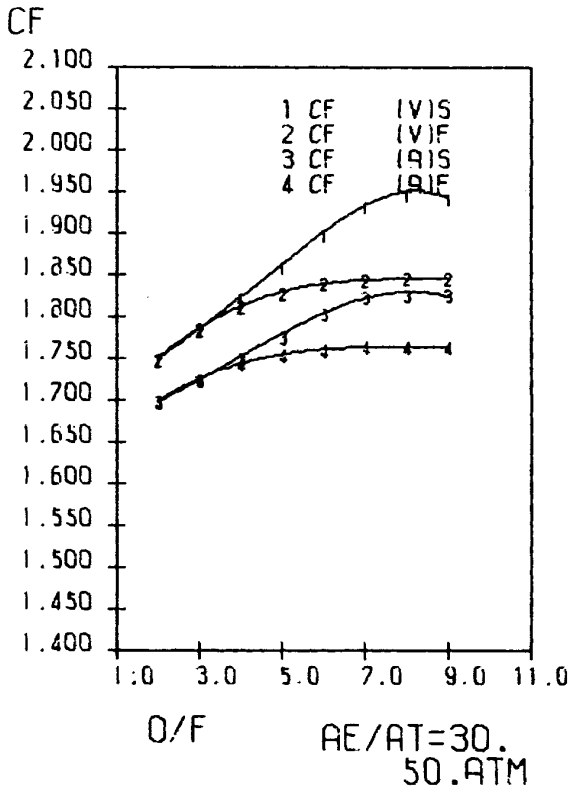
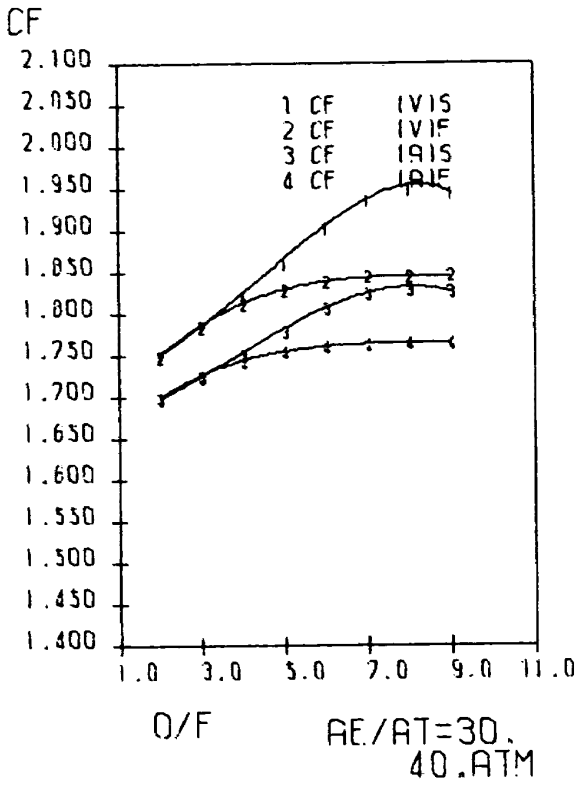
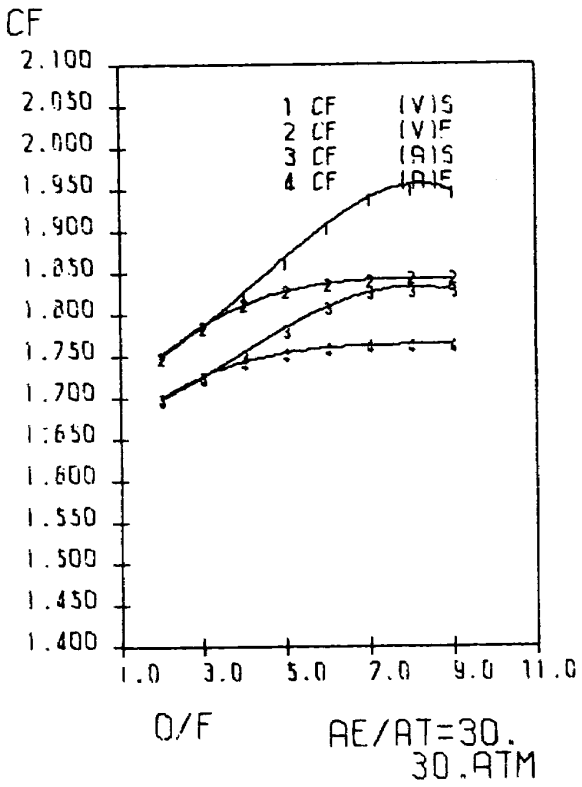
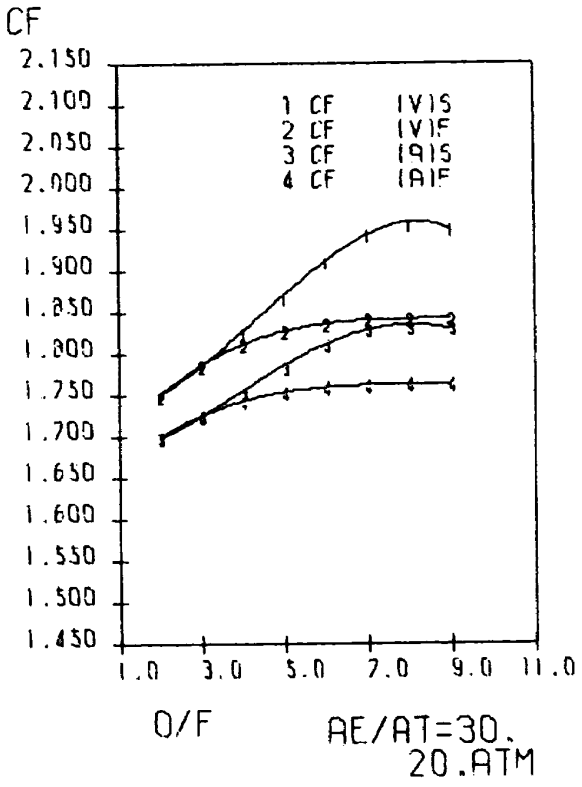


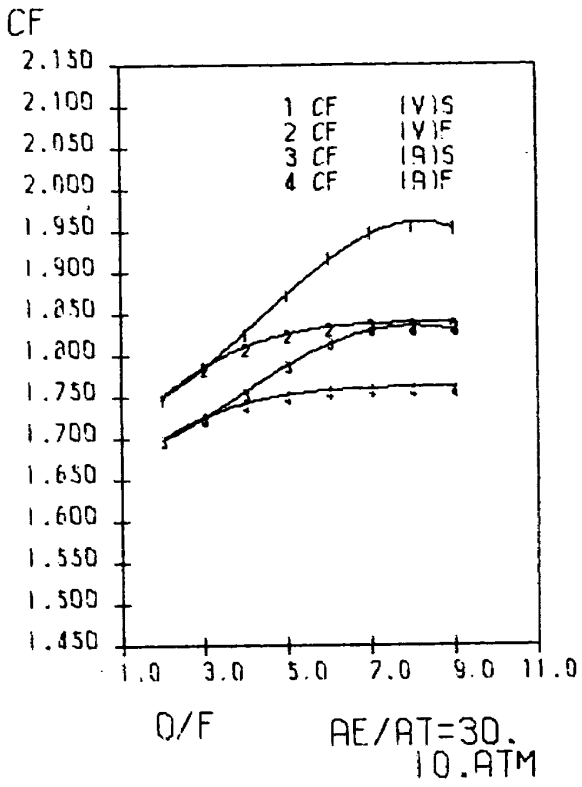
図 B 4 － 5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



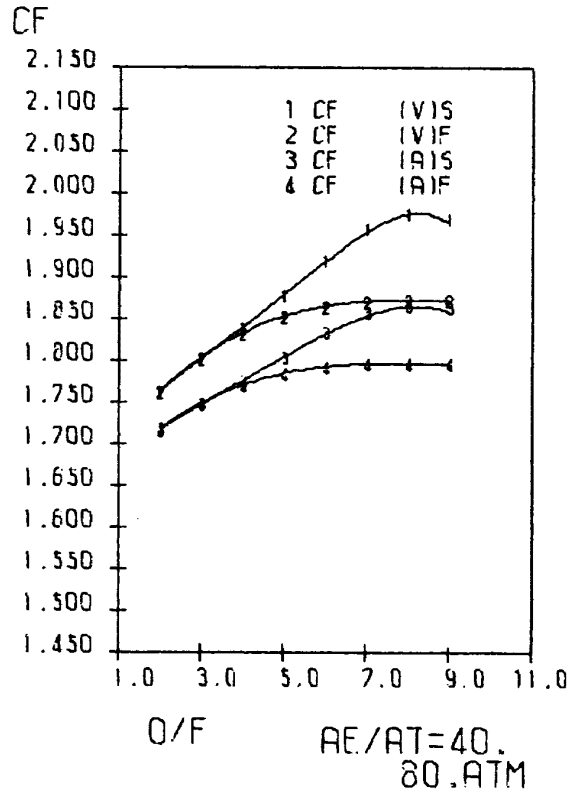


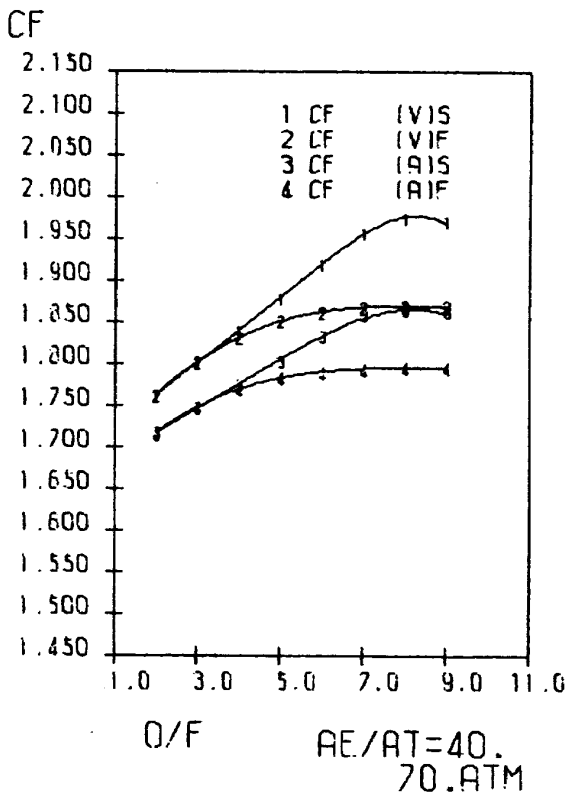


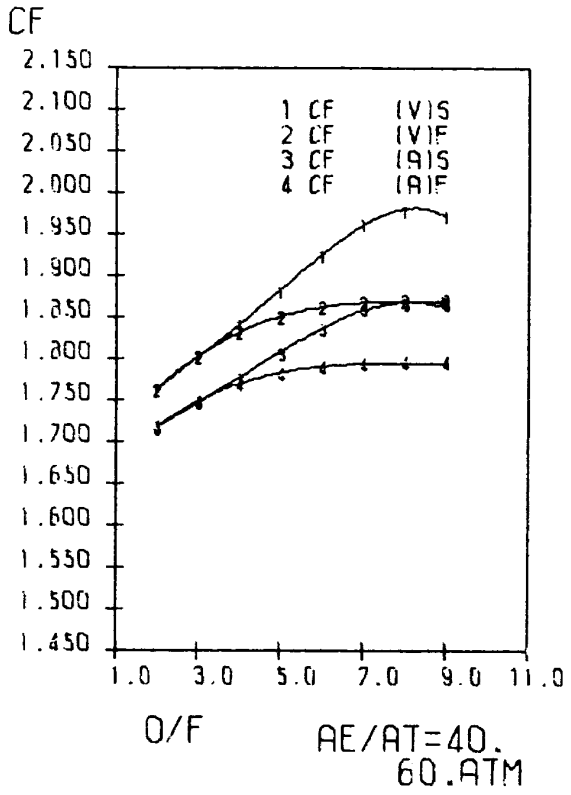


図B 4 − 6

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







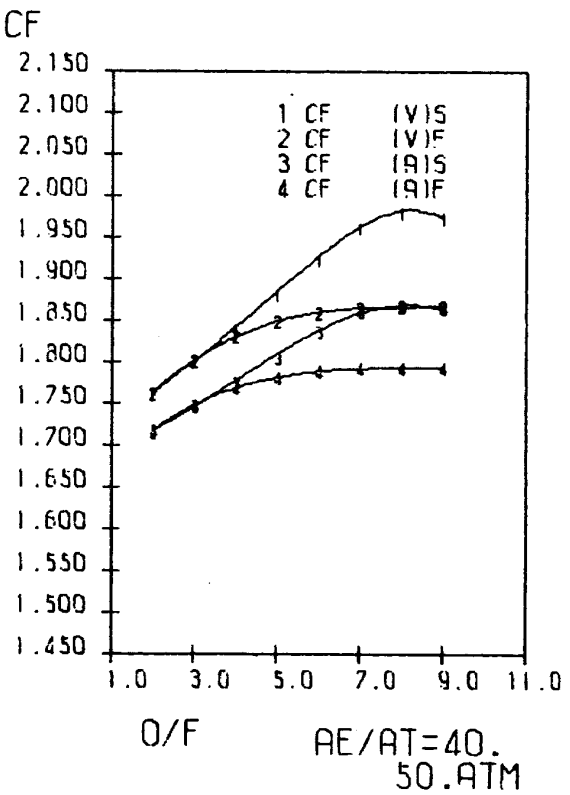
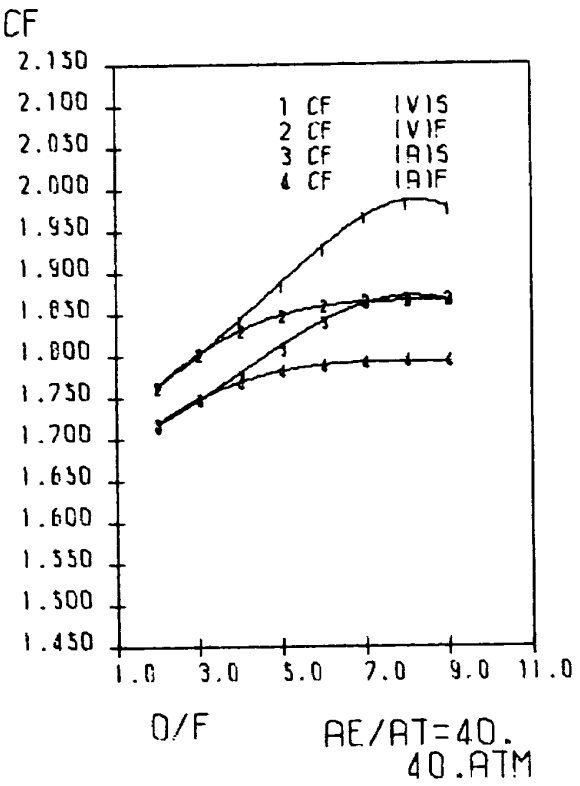
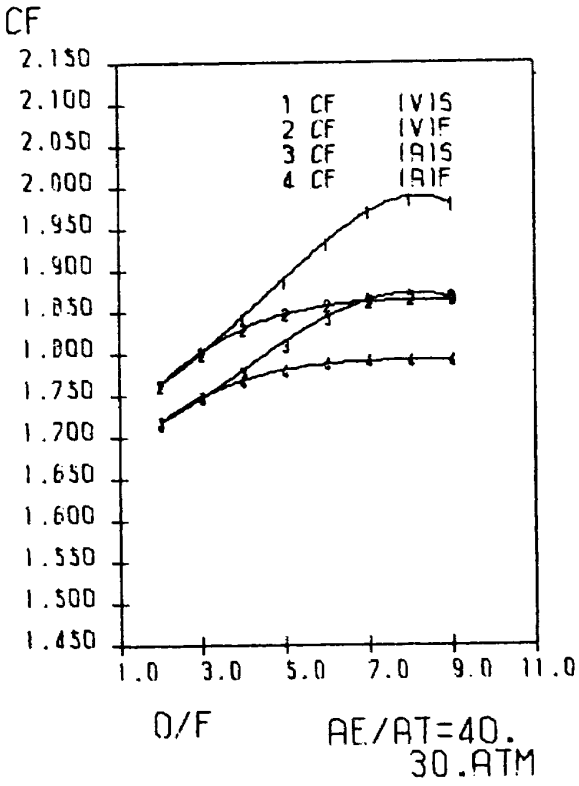
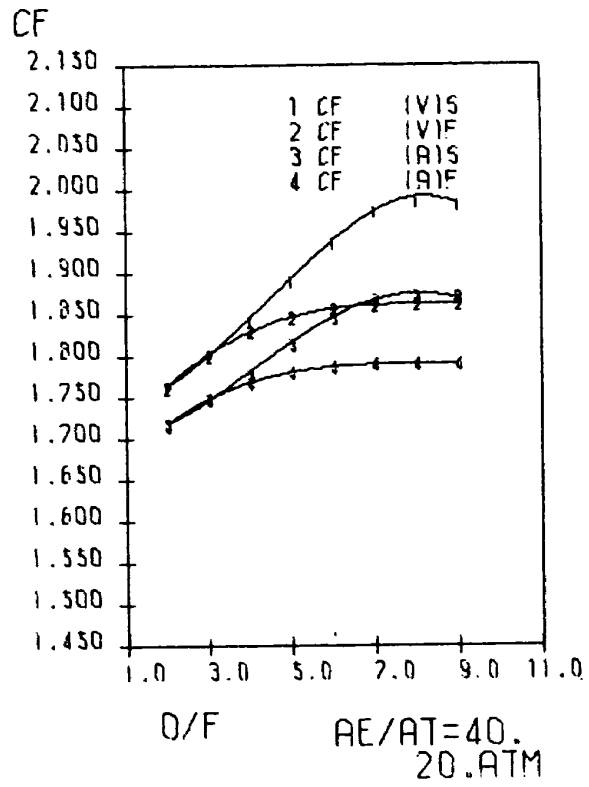


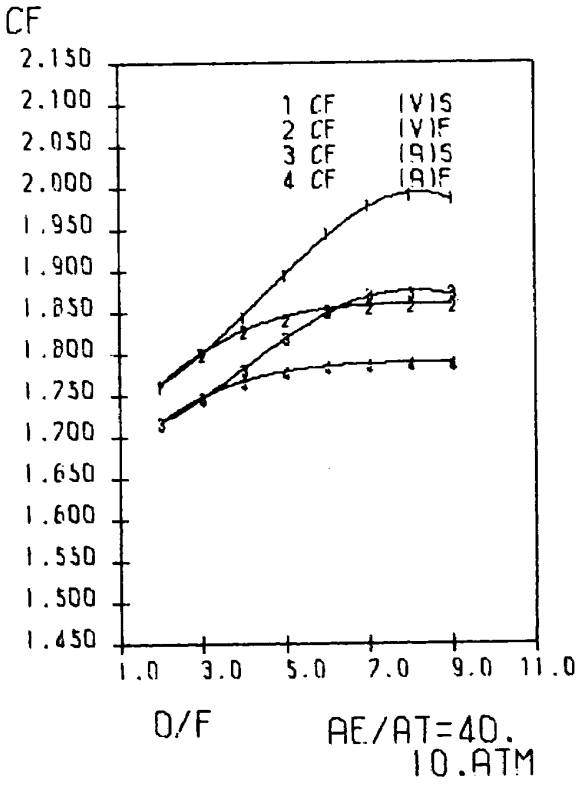
図 B 4 － 7

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



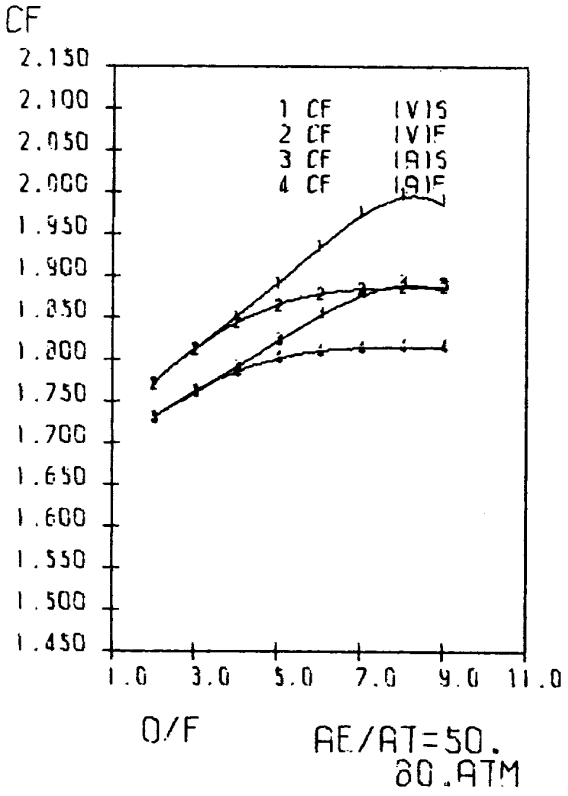


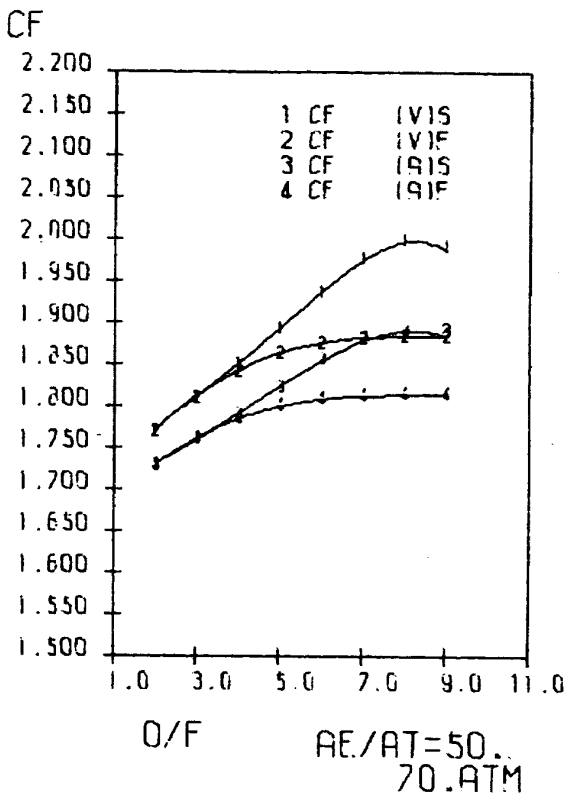


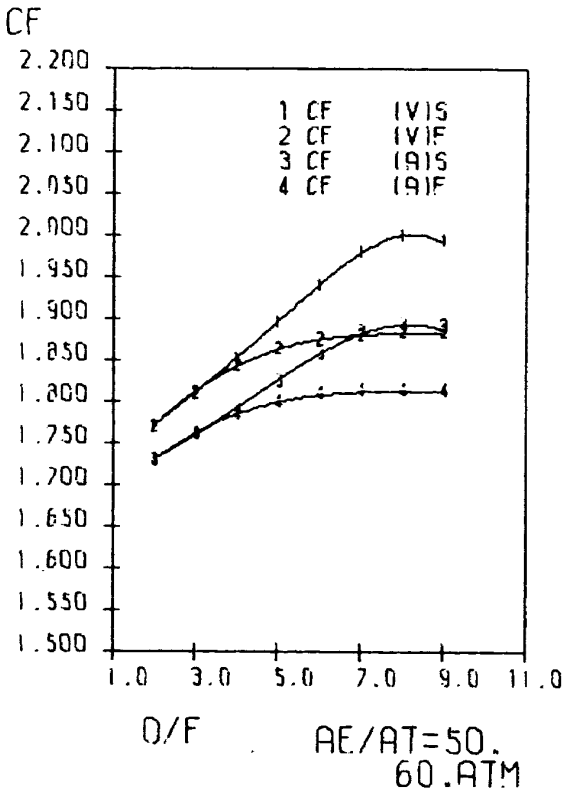


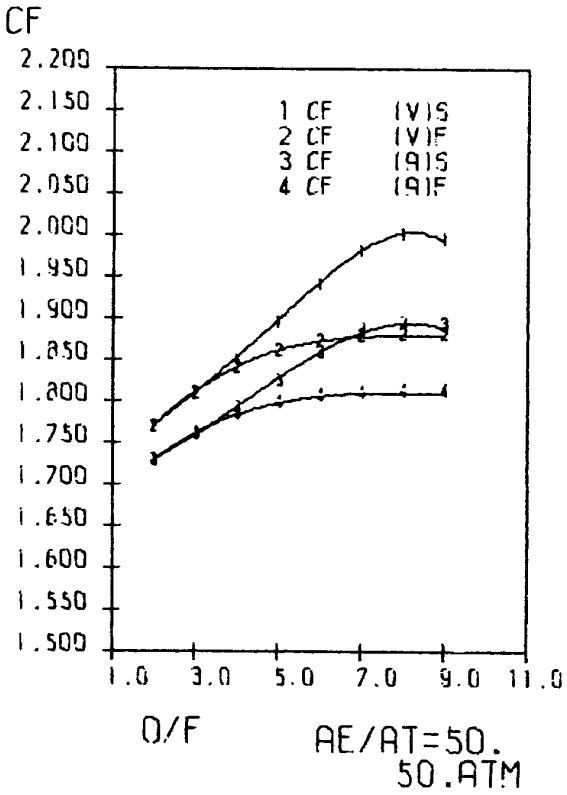
図B4－8

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



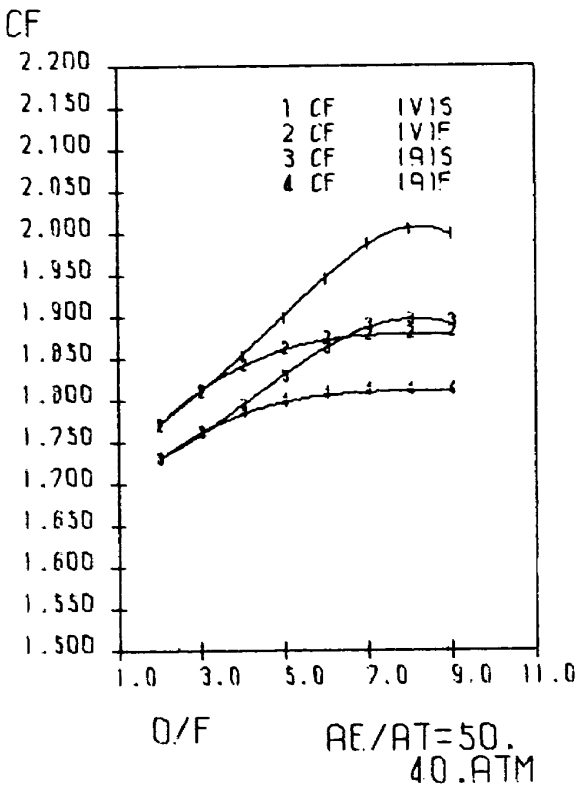


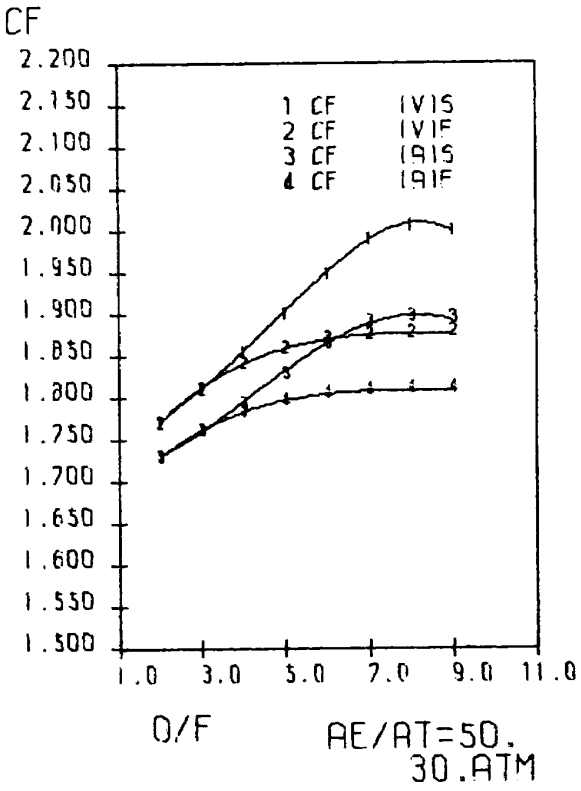


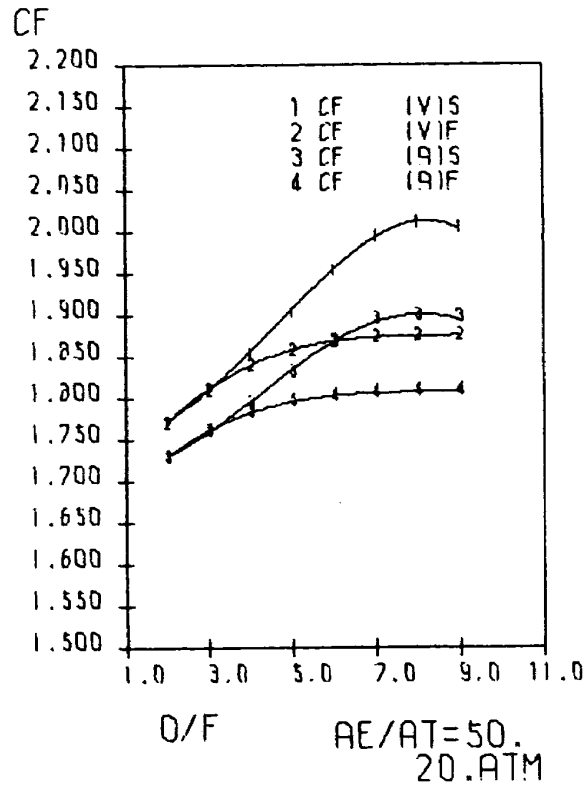


図B 4－9

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







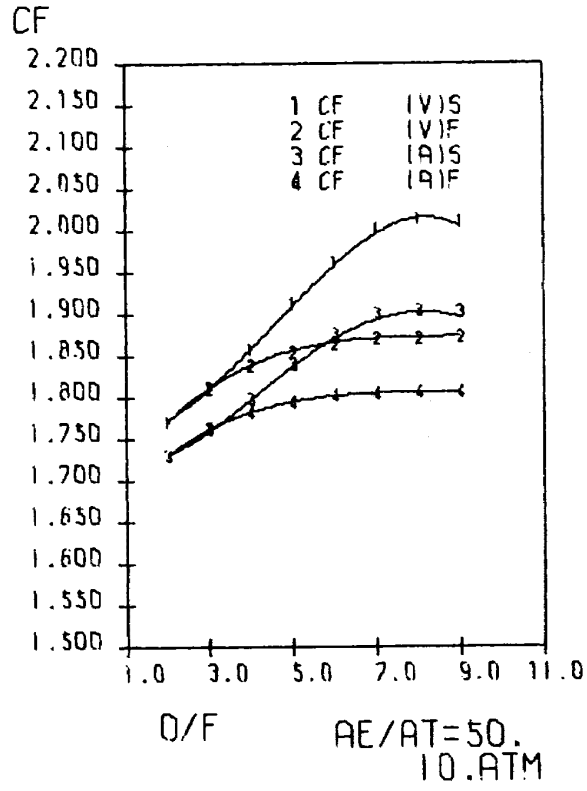
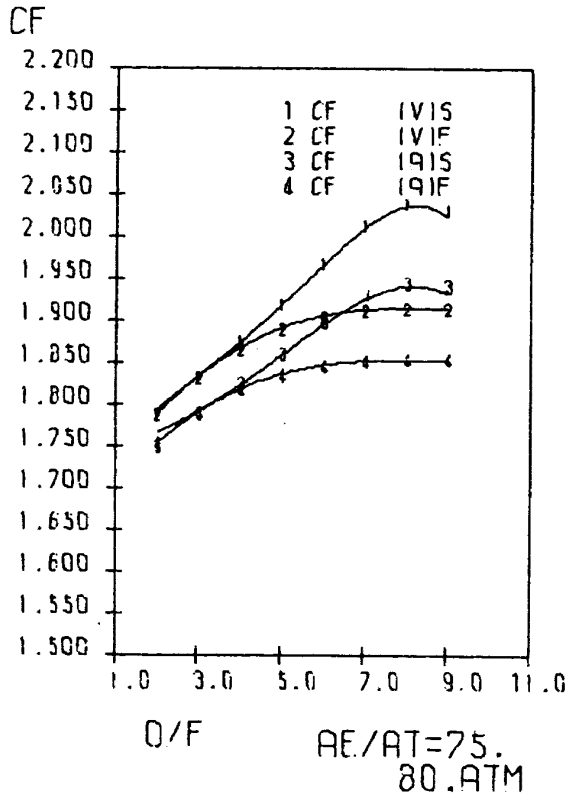
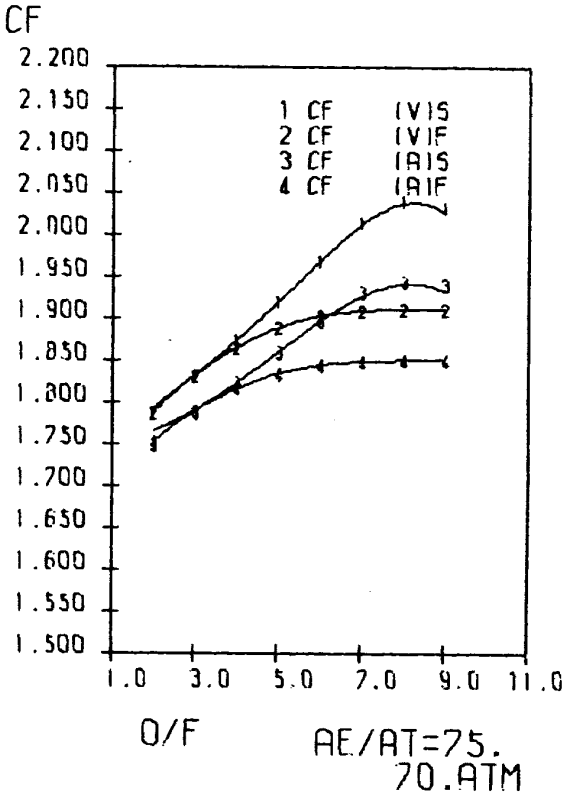
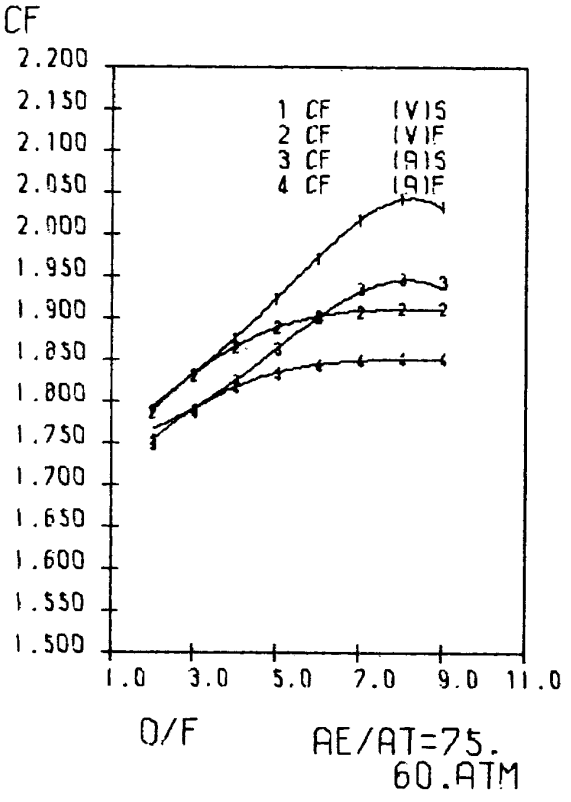


図 B 4－10

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







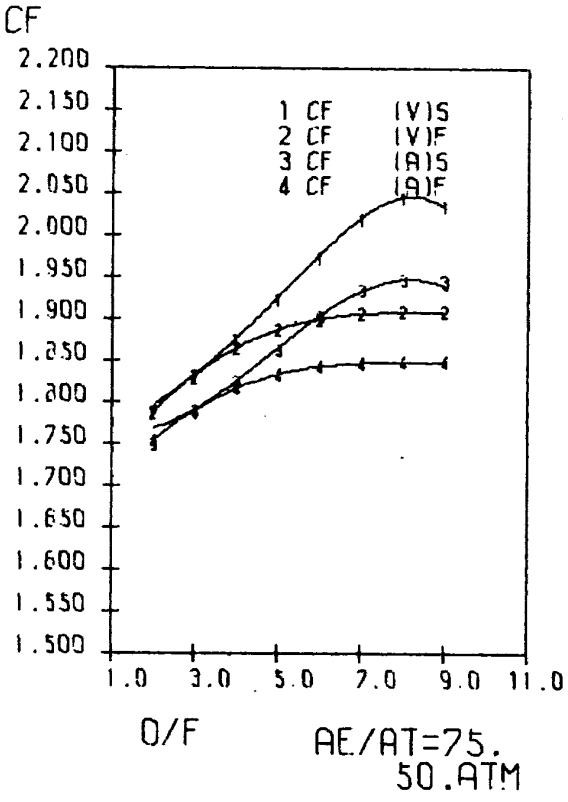
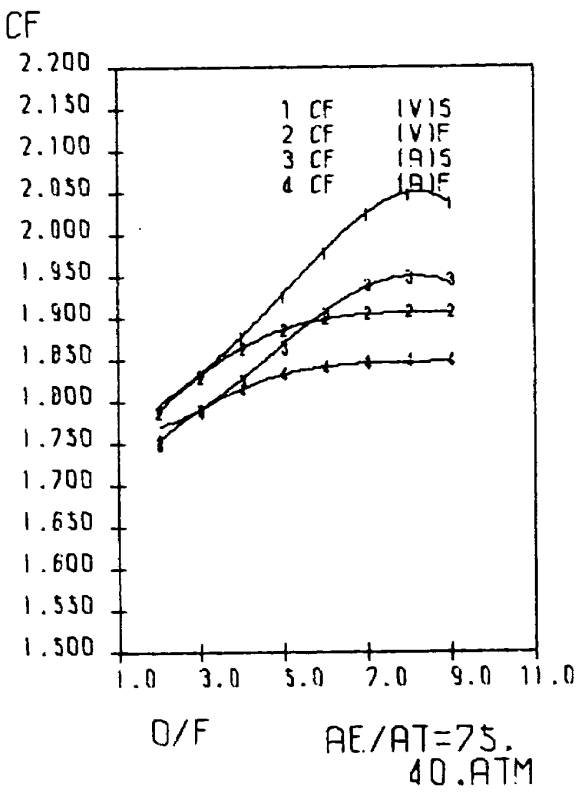
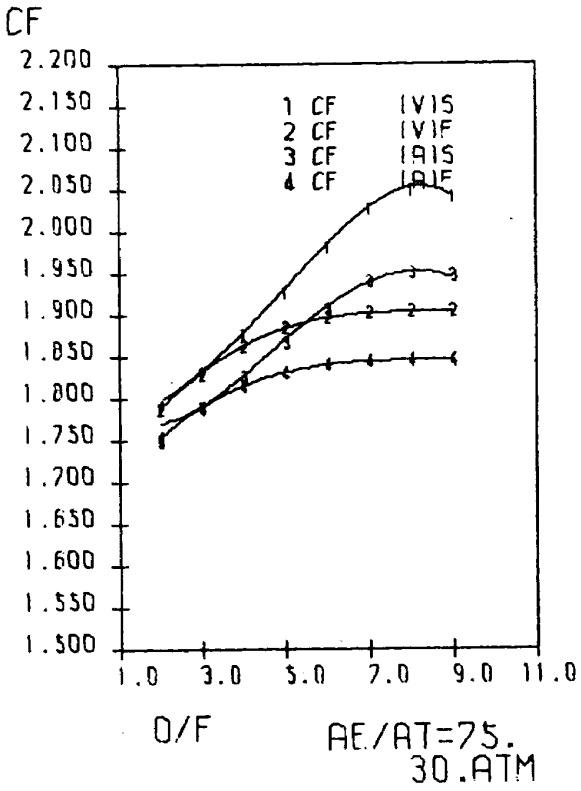
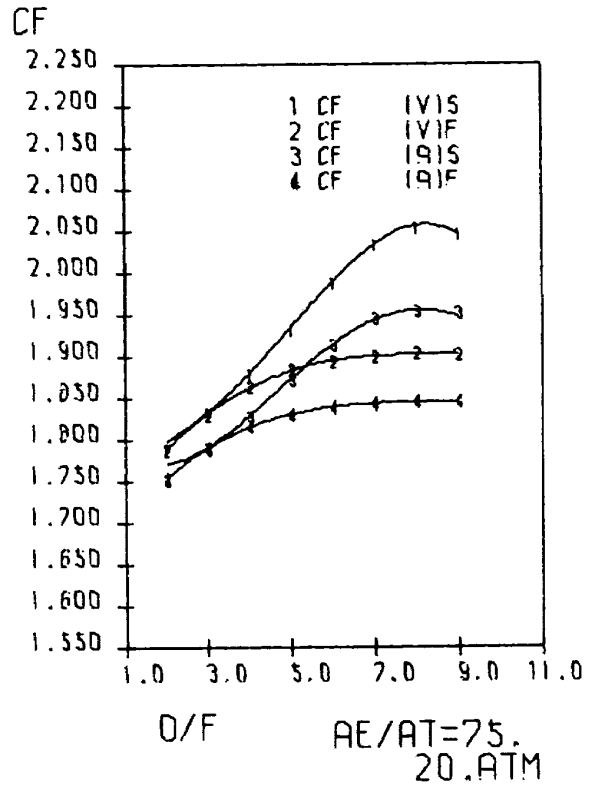


図 B 4－11

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







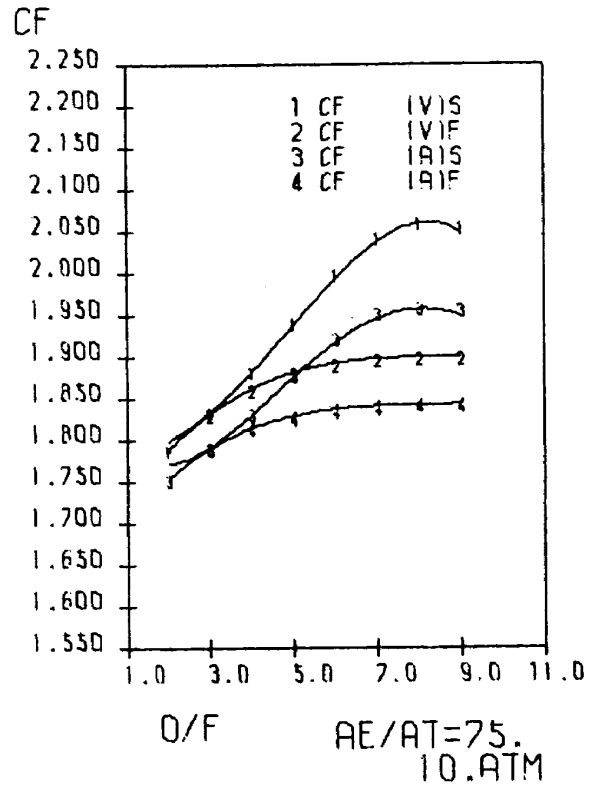
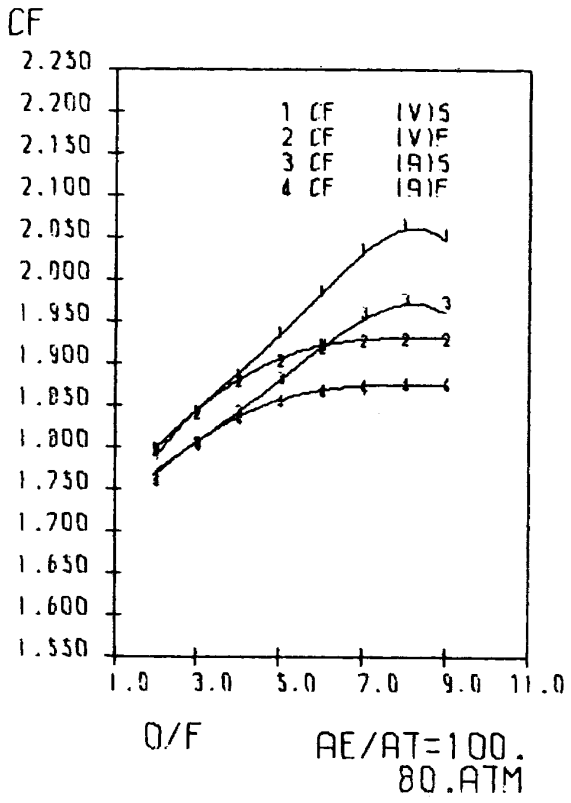
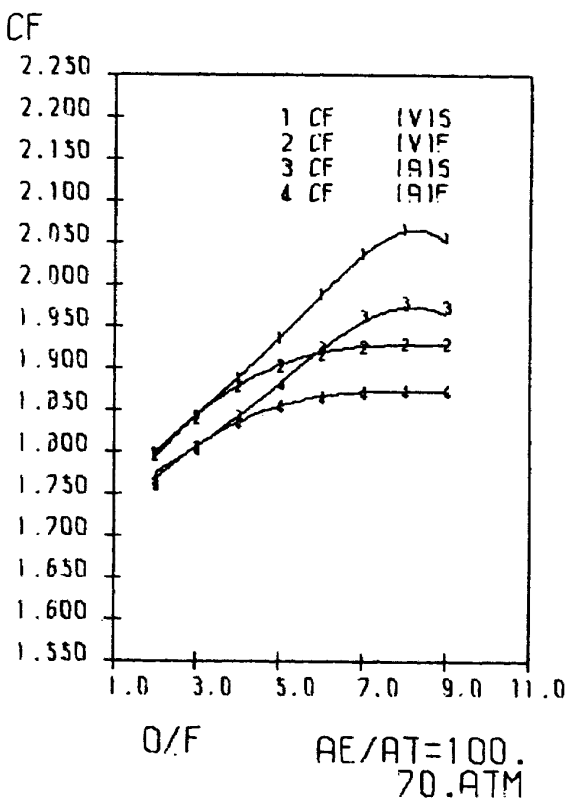
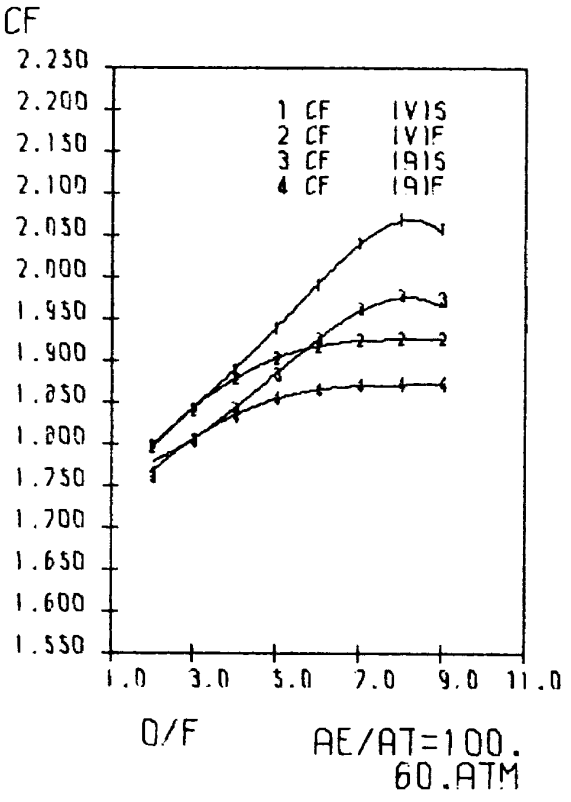


図 B 4－12

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







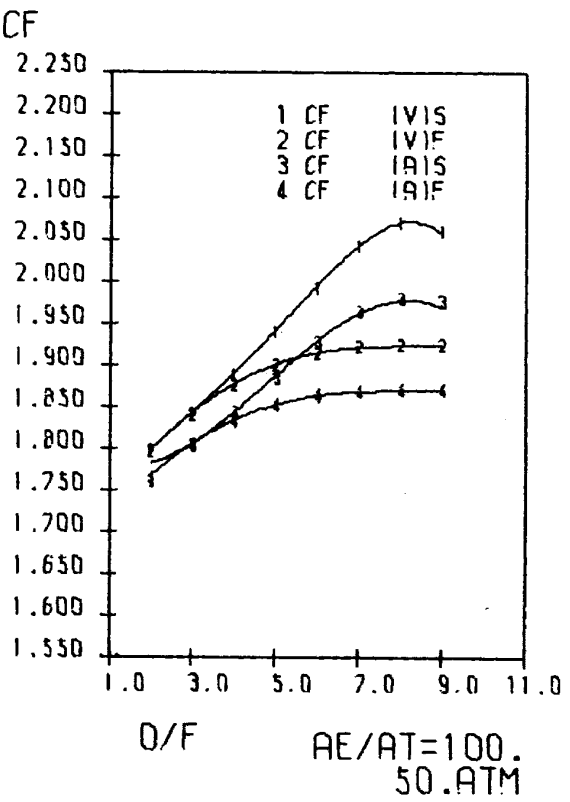
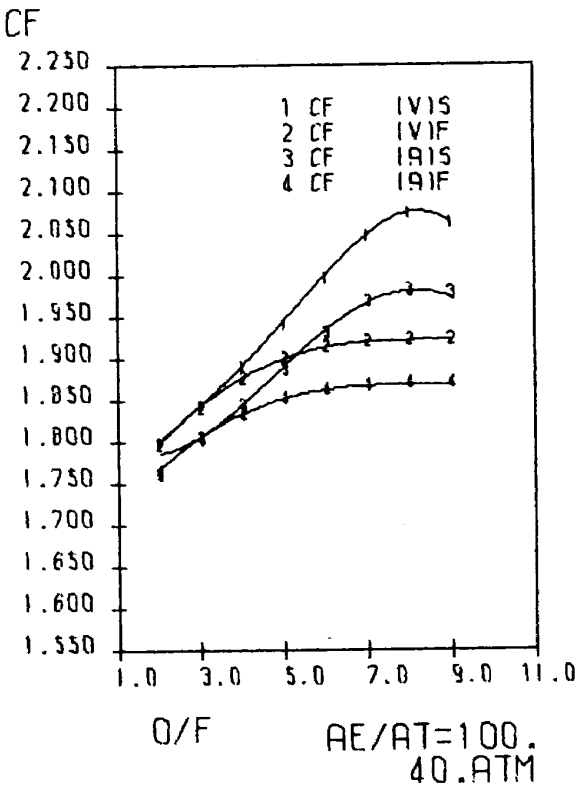
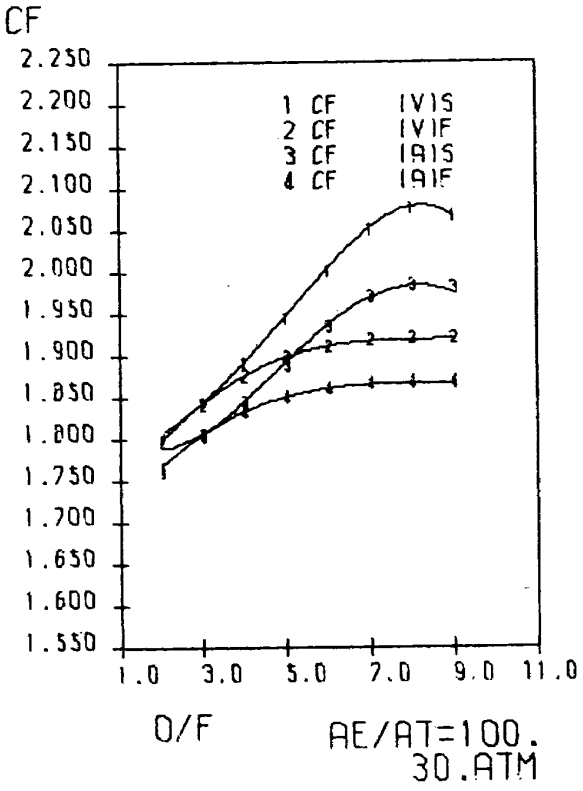
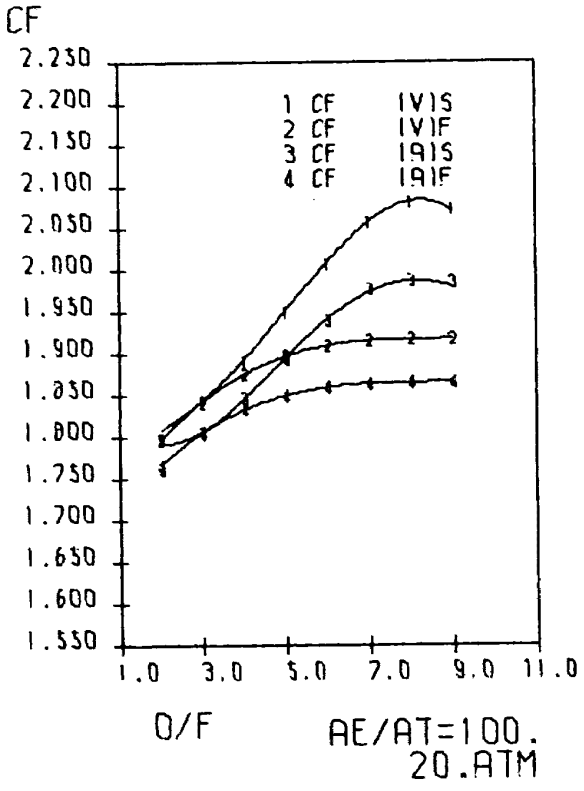


図 B 4—13

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







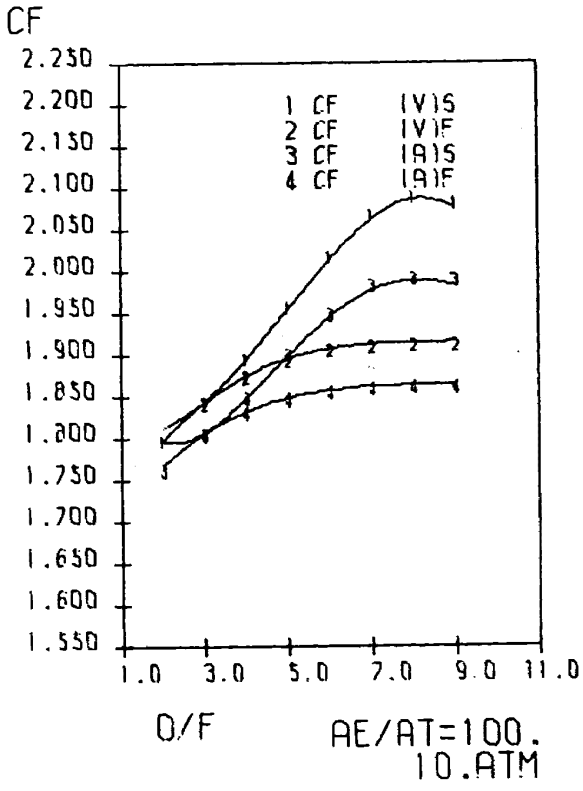
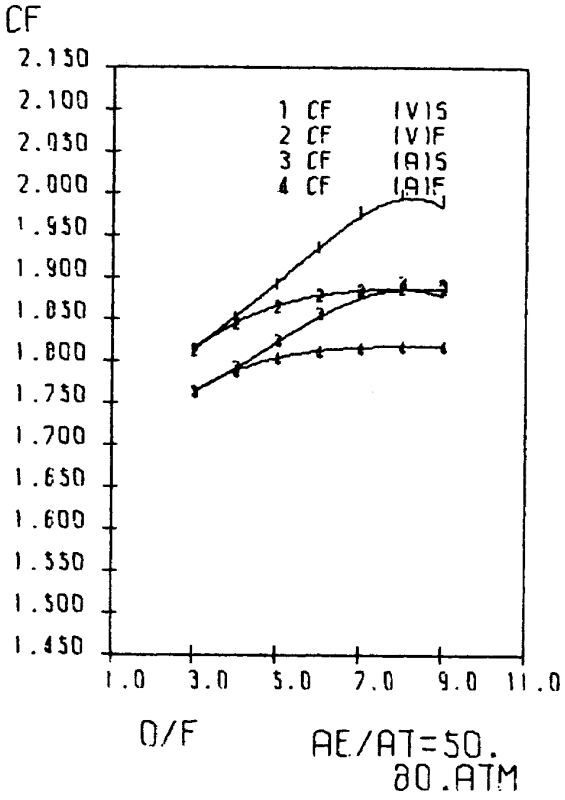
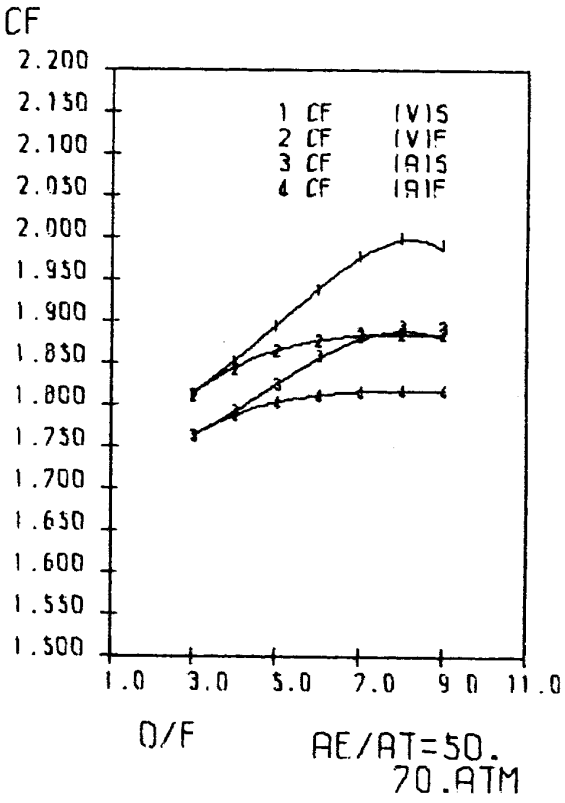
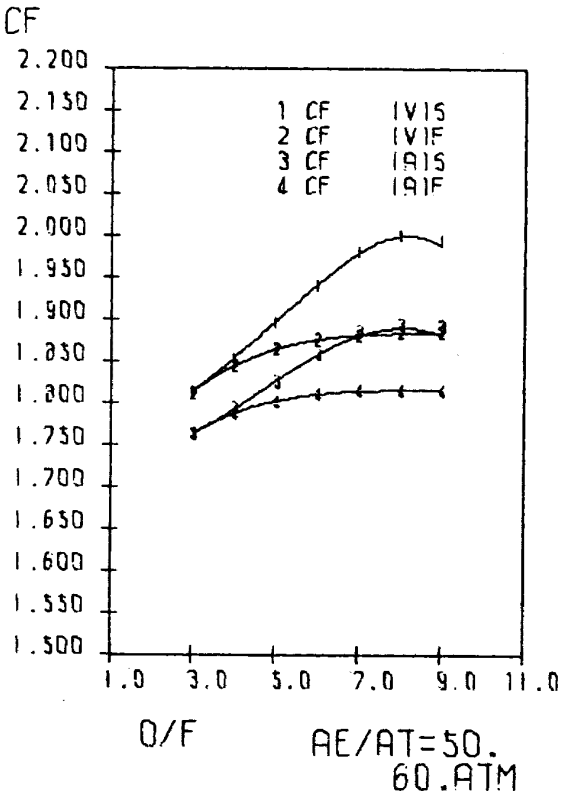


図 B 4－14

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







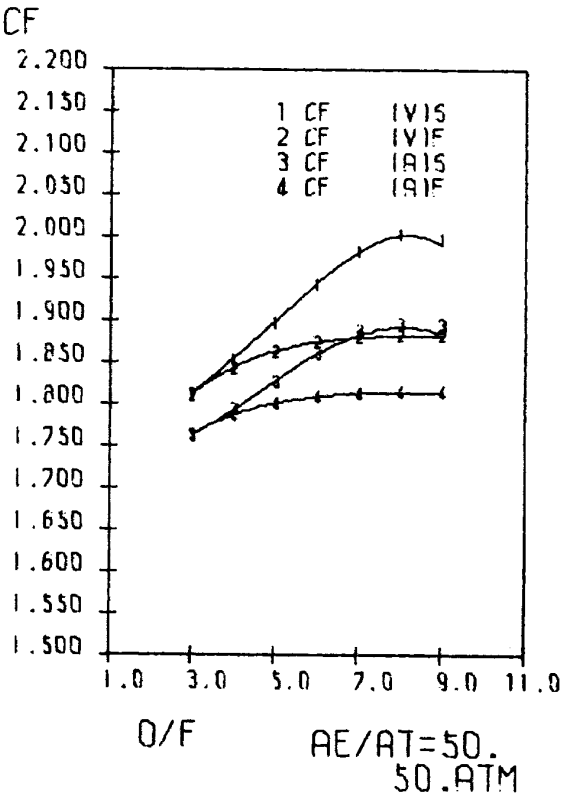
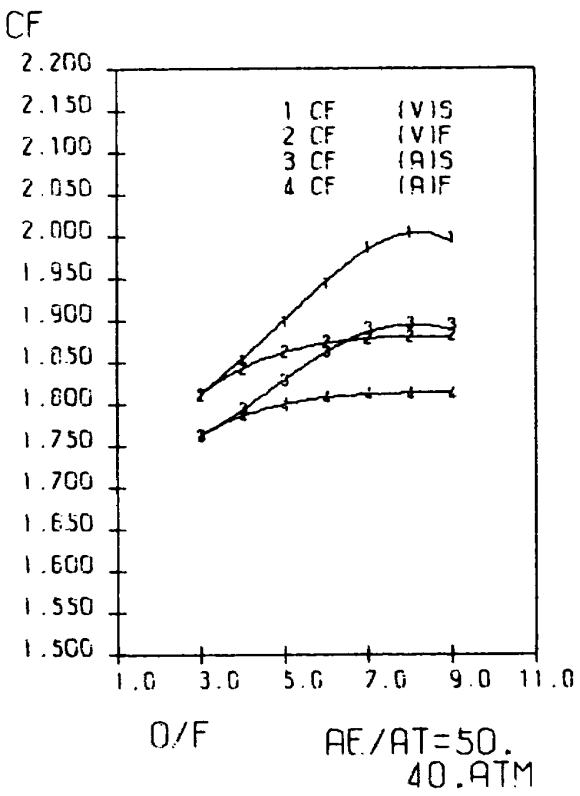
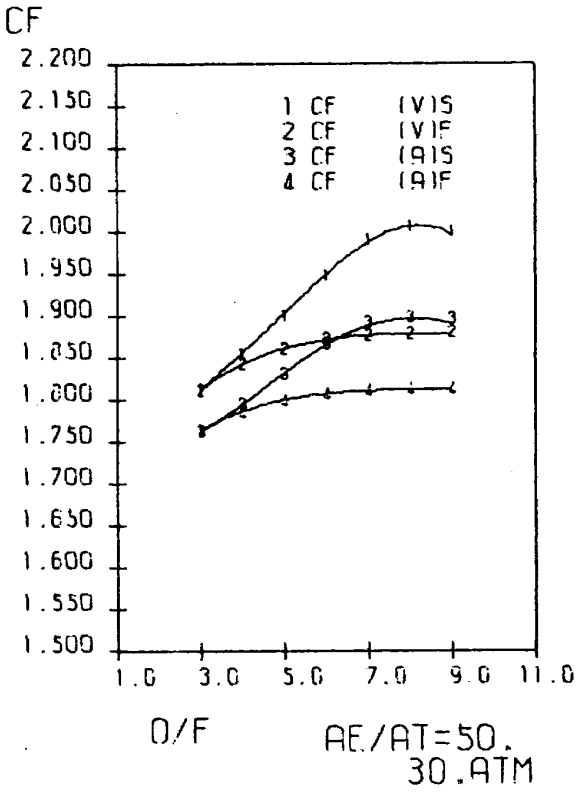
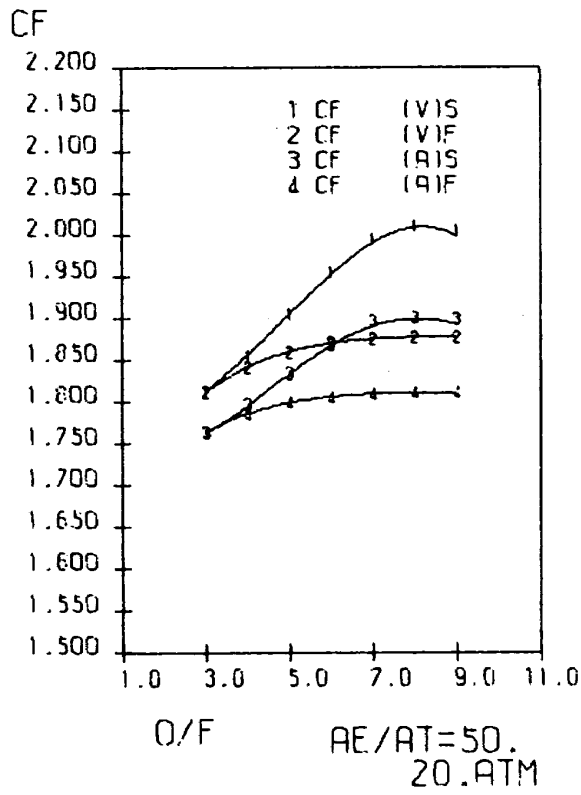


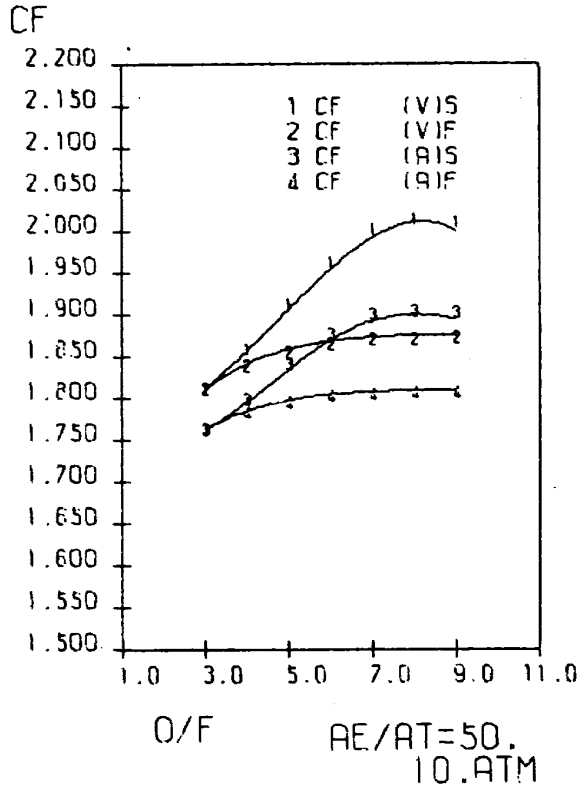
図 B 5 − 1

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



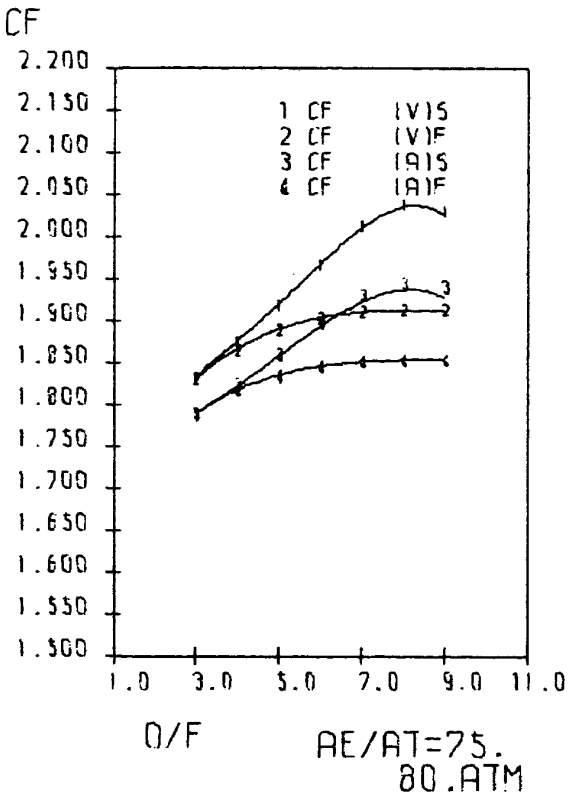


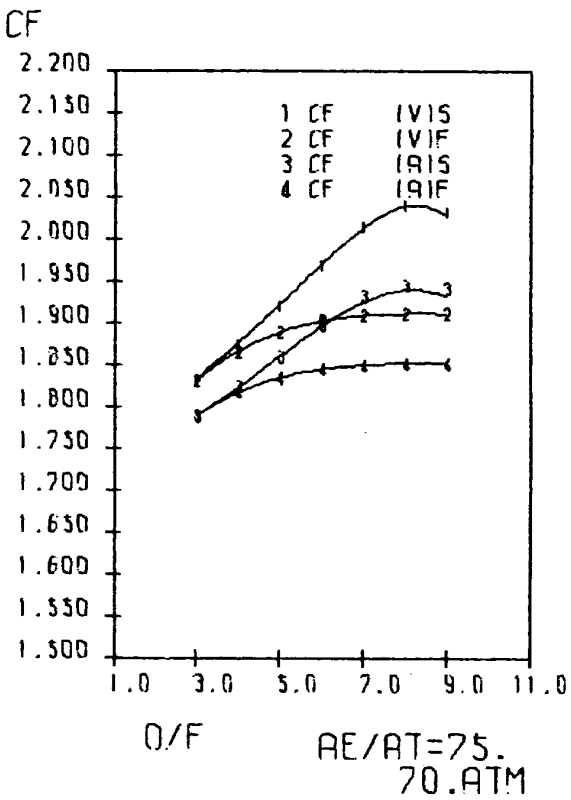


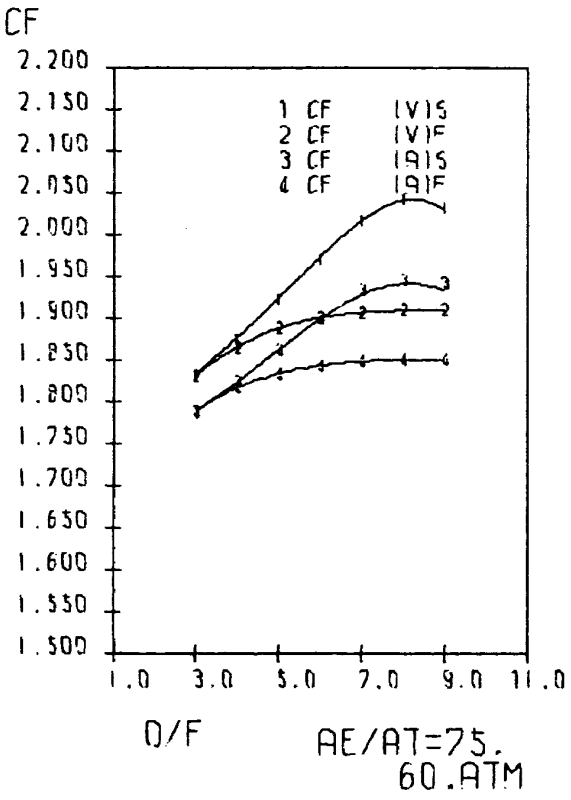


図B 5－2

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







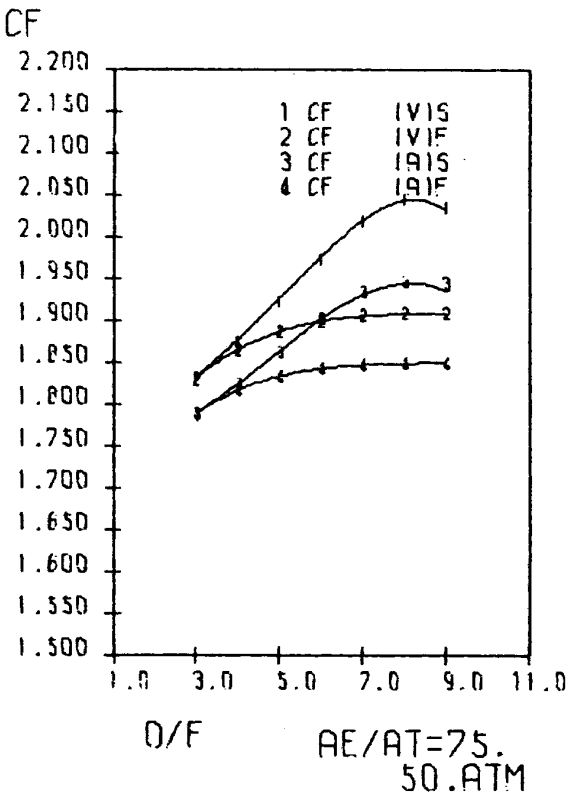
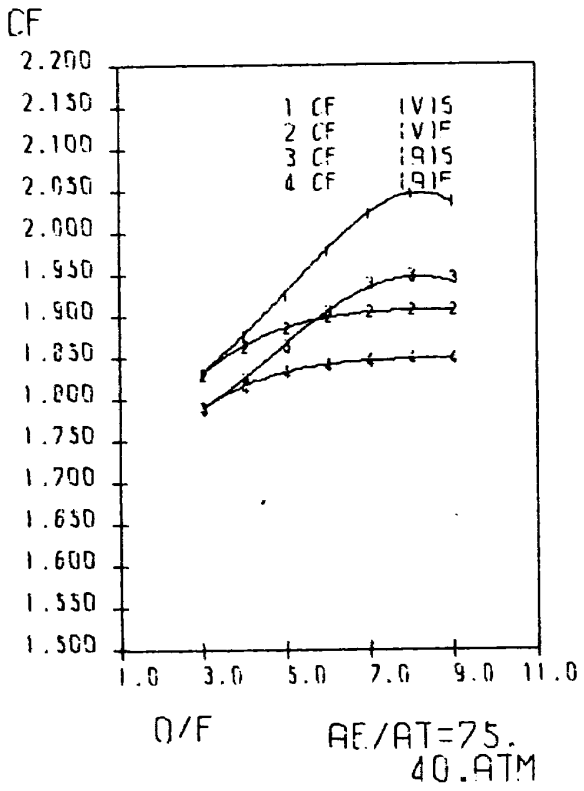
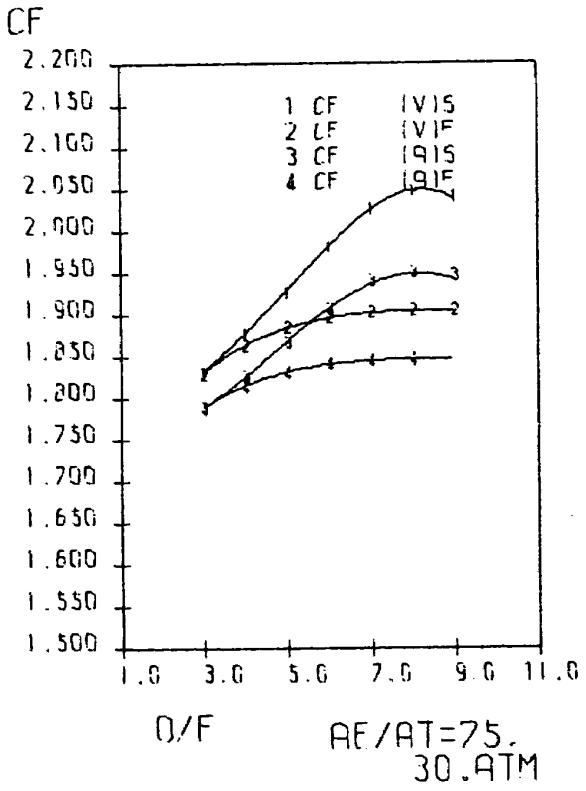
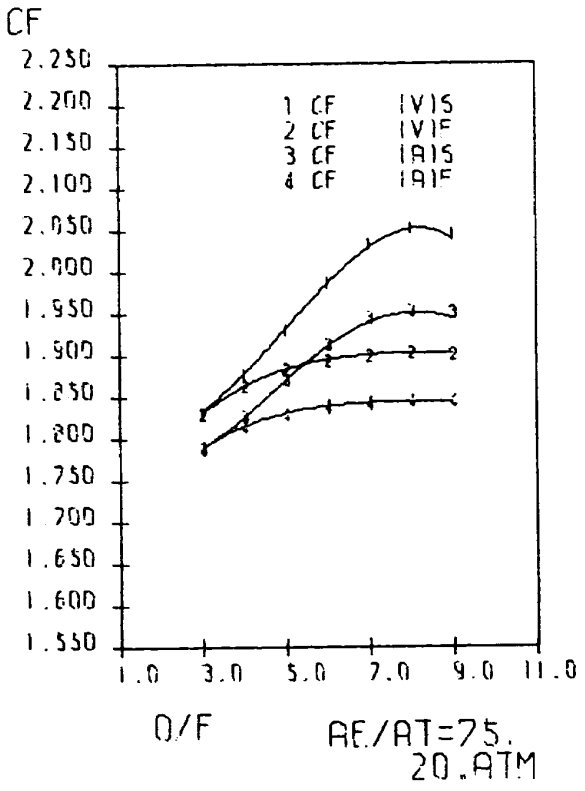


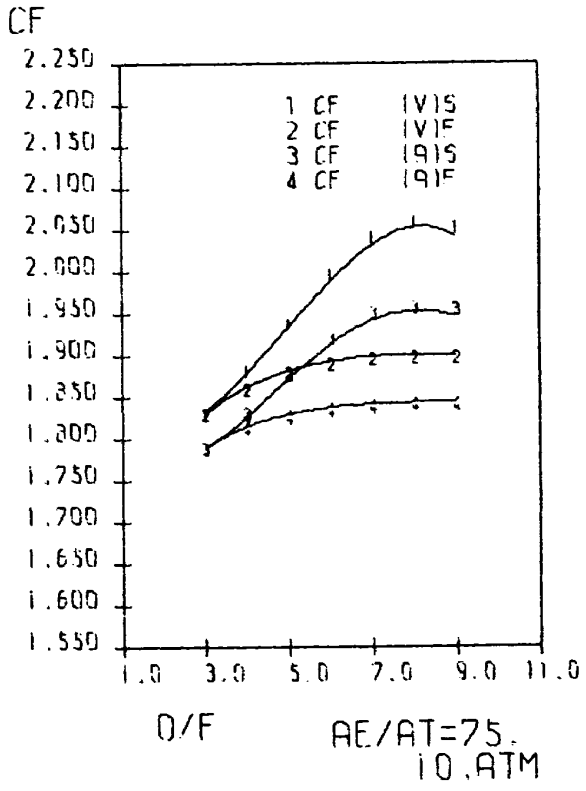
図 B 5 － 3

CHEMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	G	1.1490



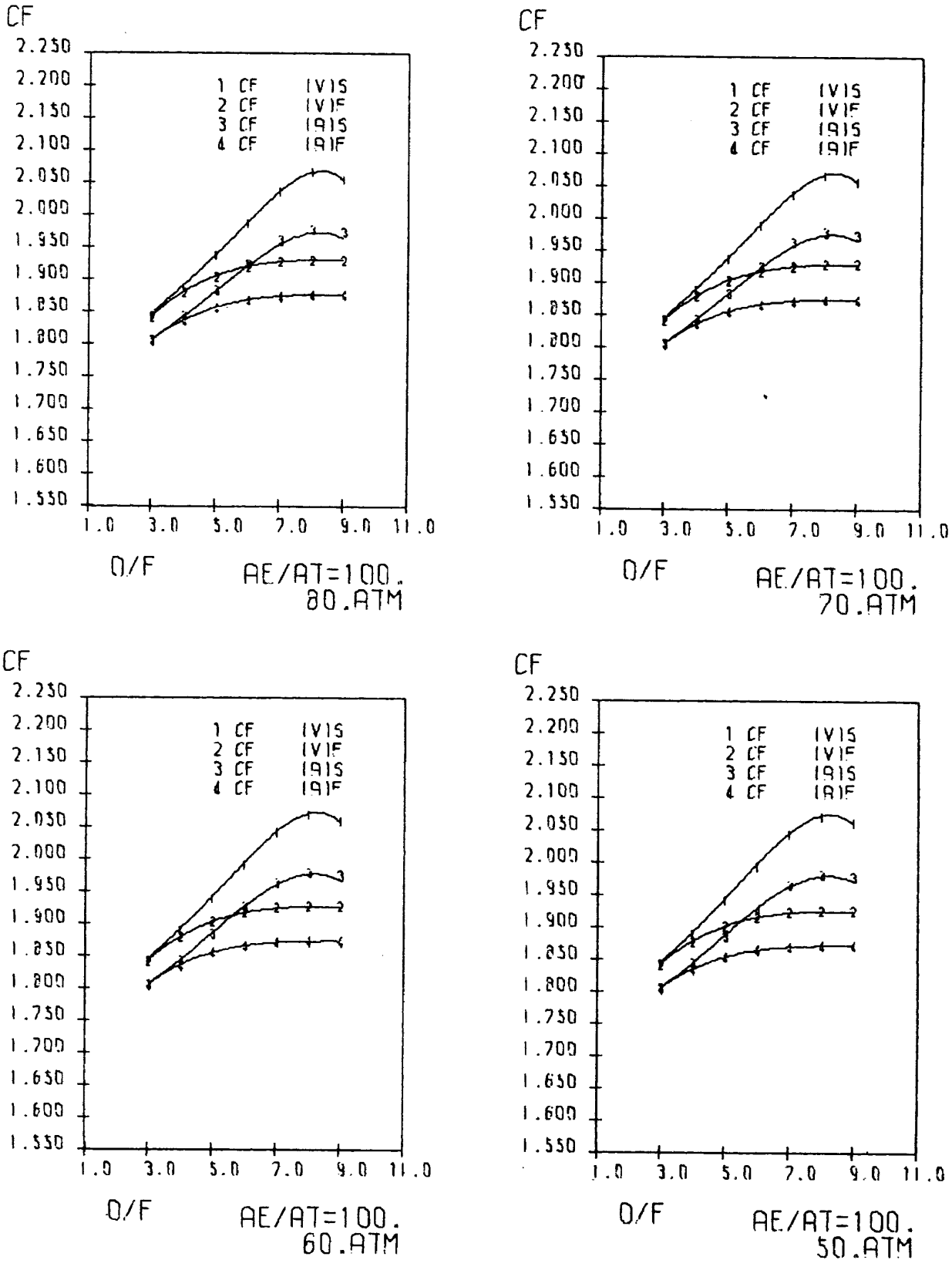






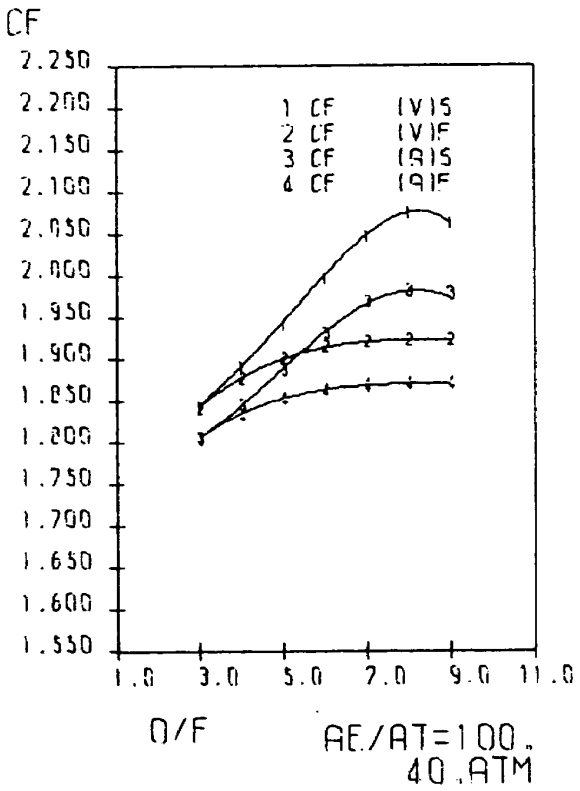
図B 5 － 4

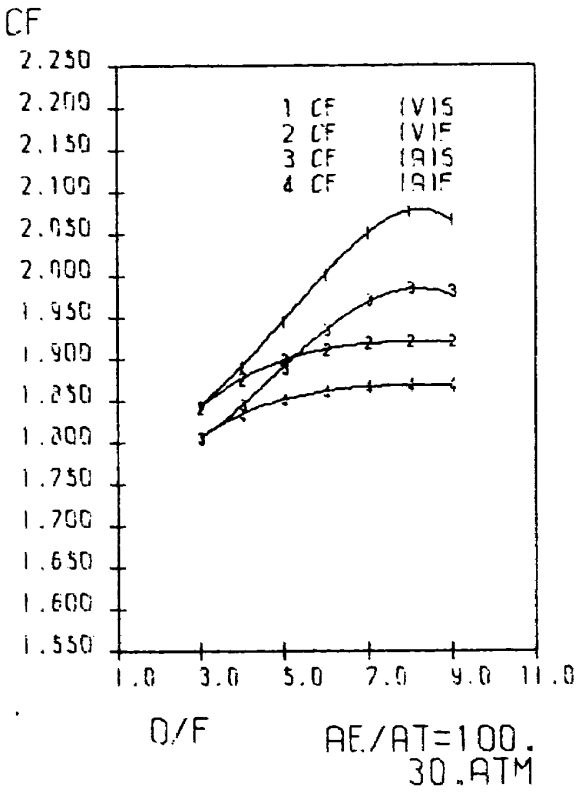
CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490

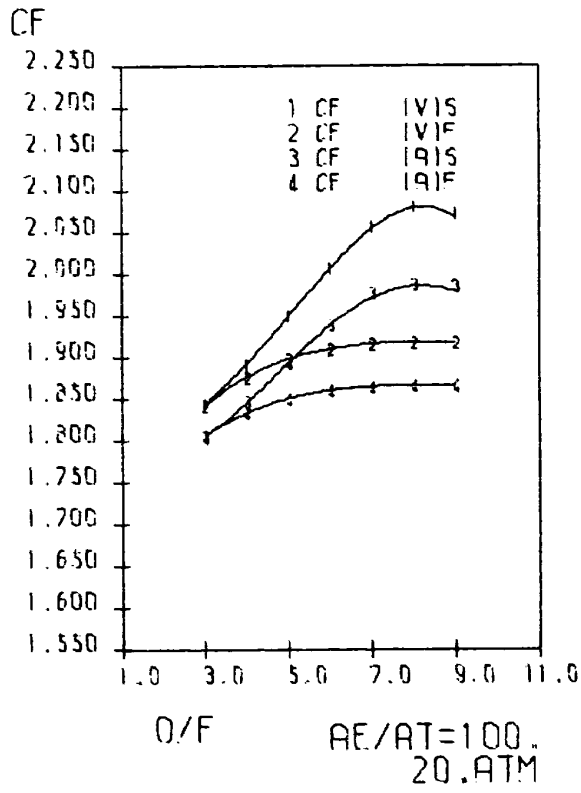


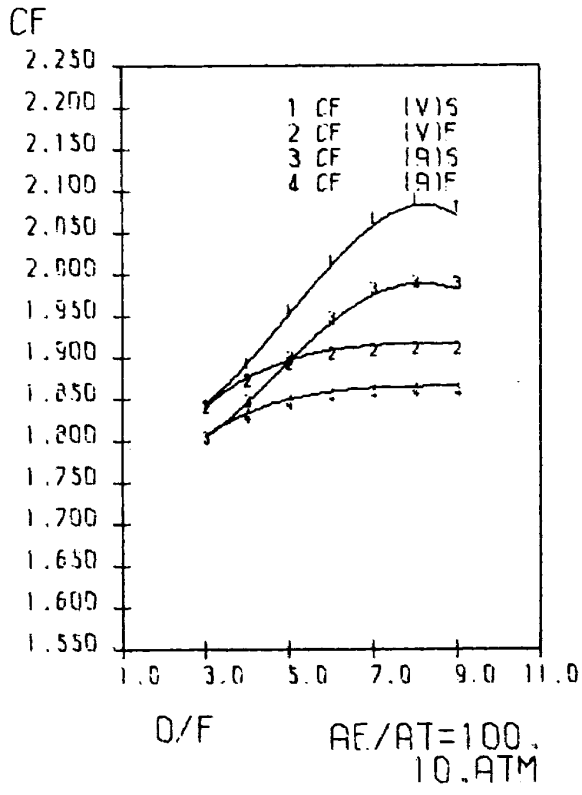
図B 5 — 5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



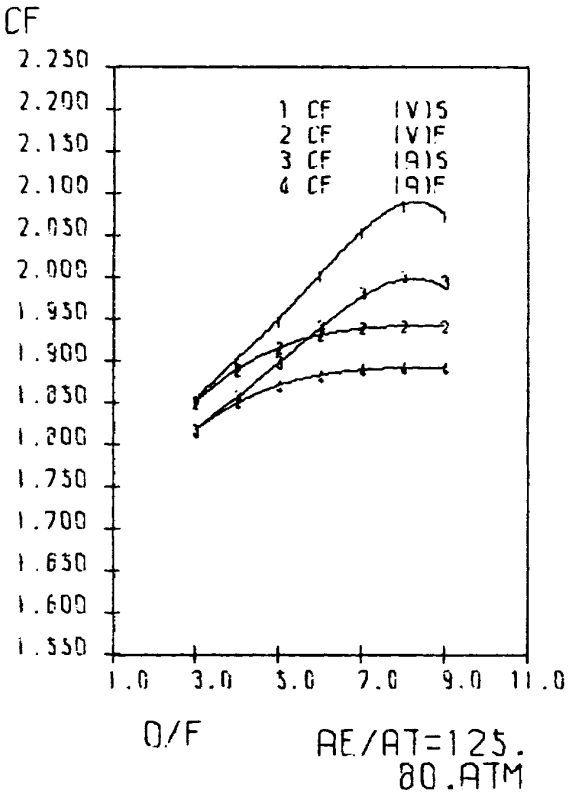


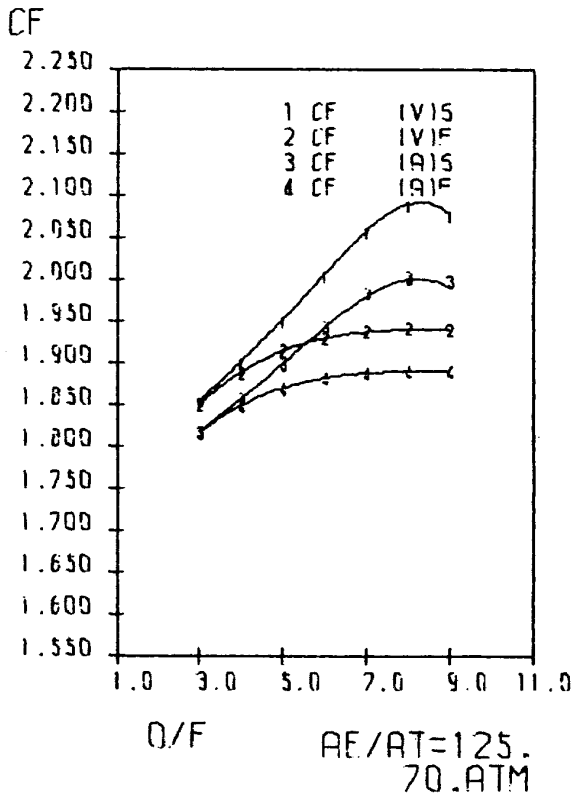


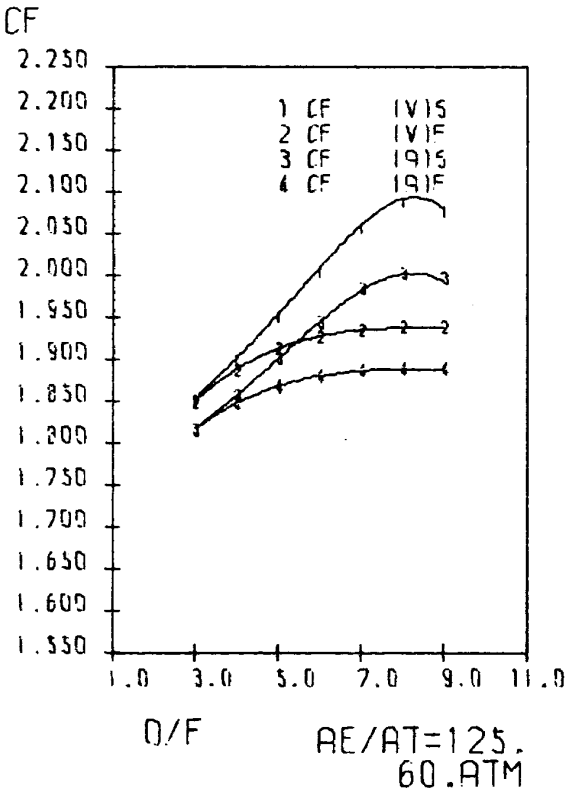


図B 5 － 6

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







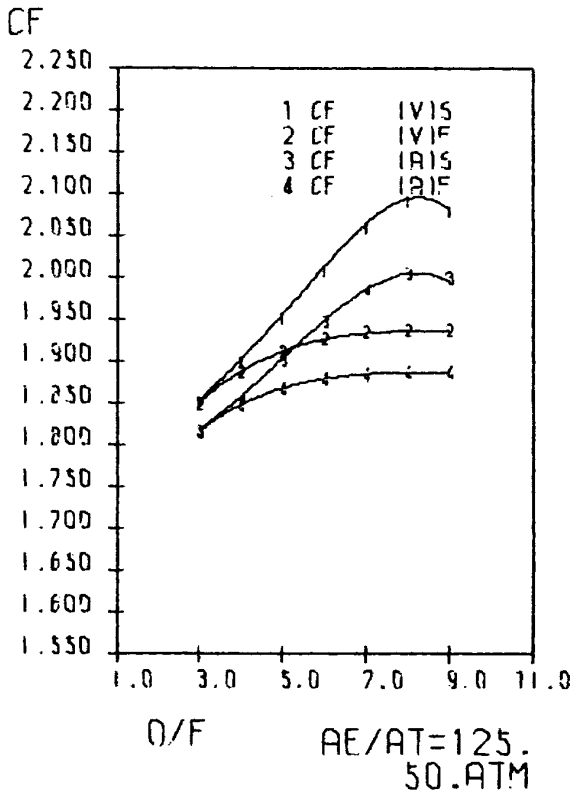
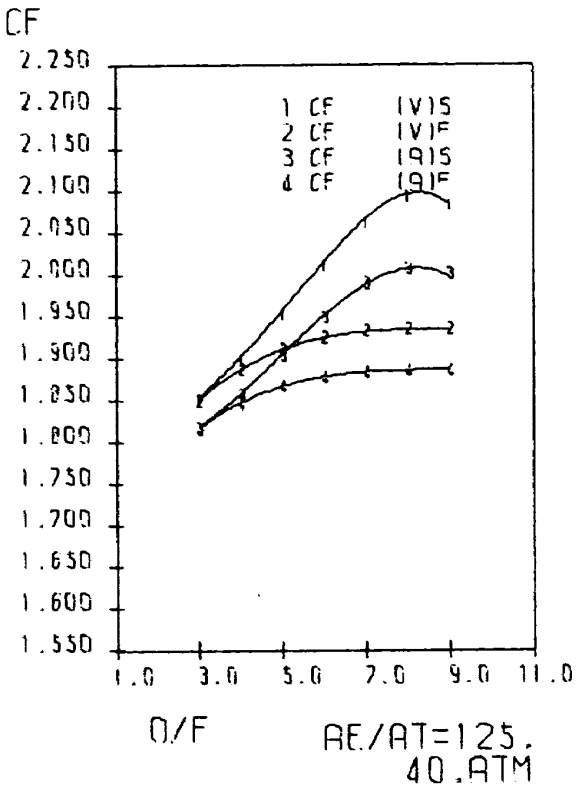
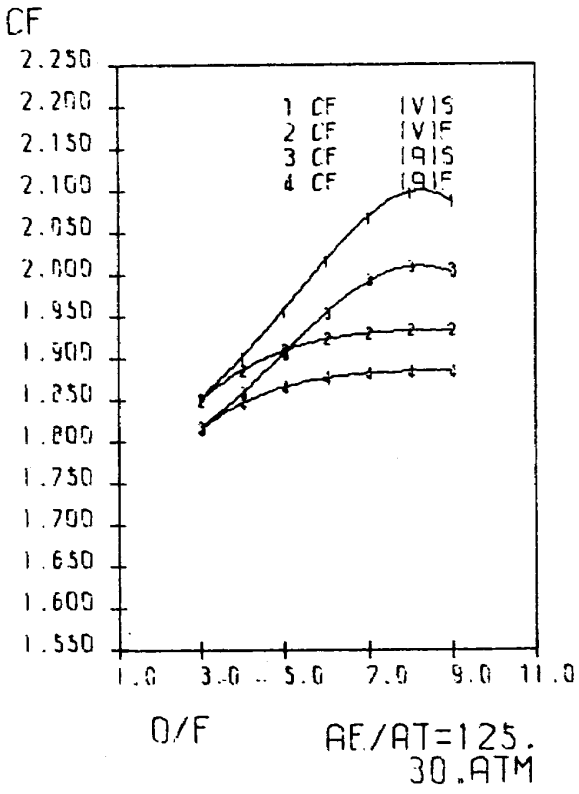
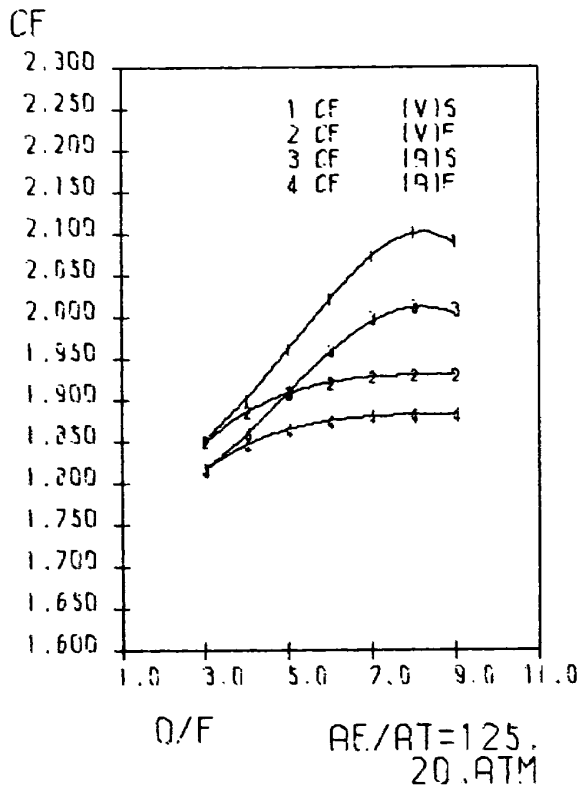


図 B 5 － 7

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







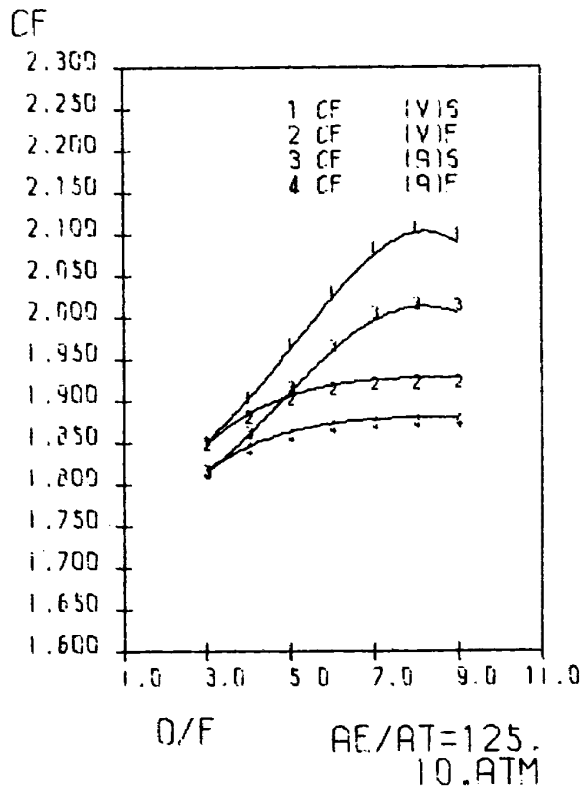
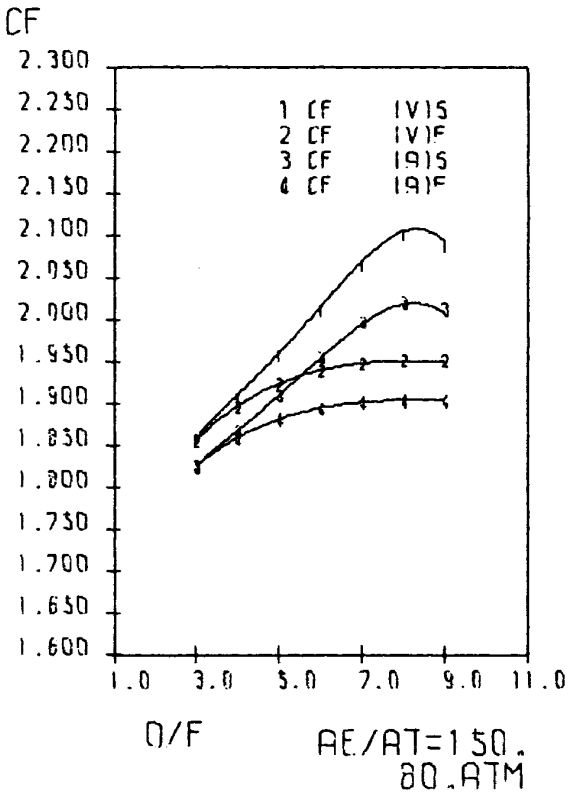
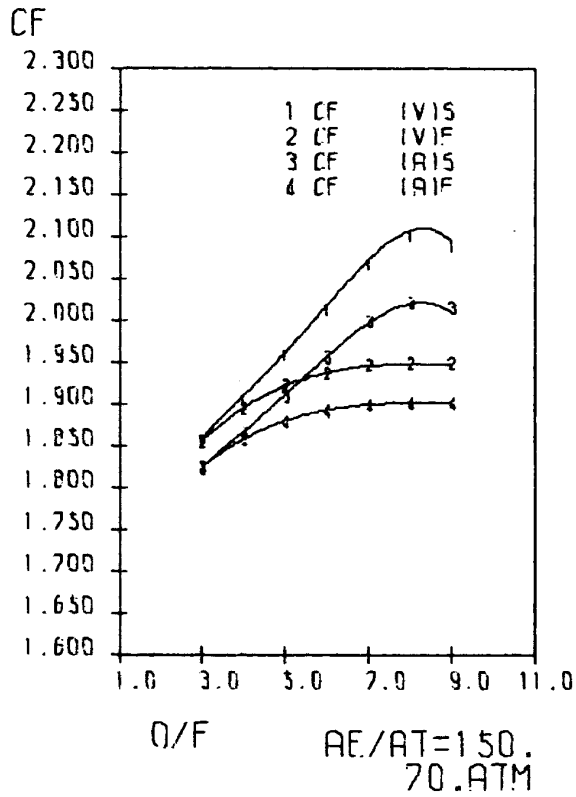
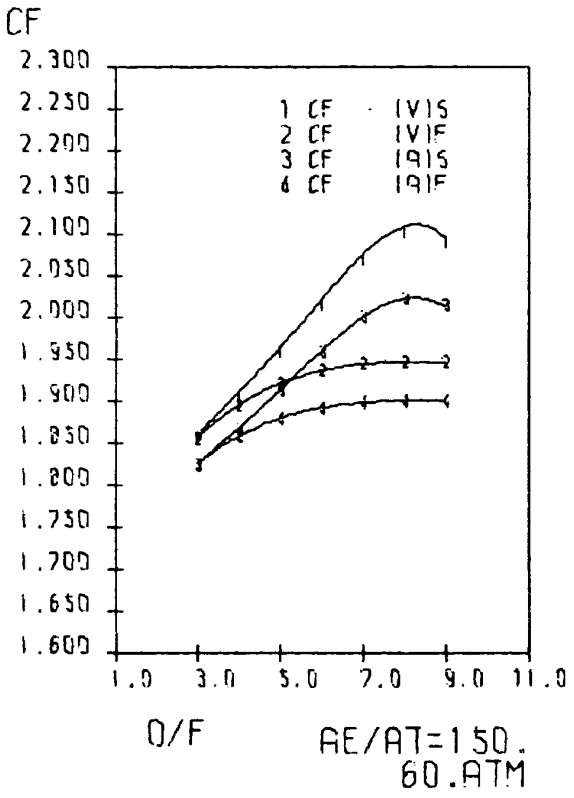


図 B 5 － 8

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







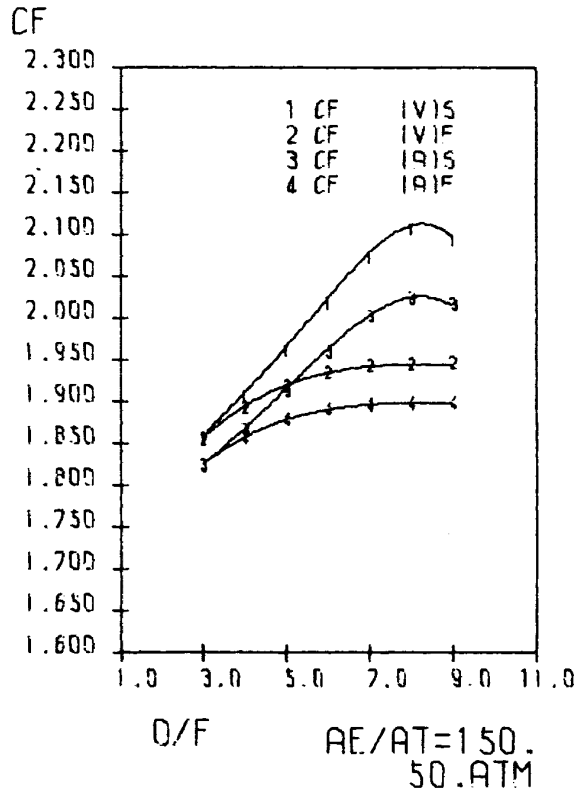
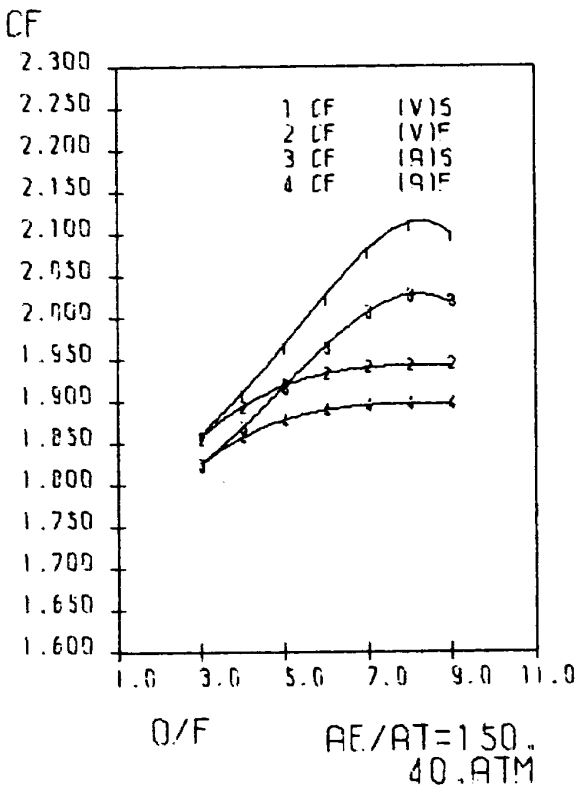
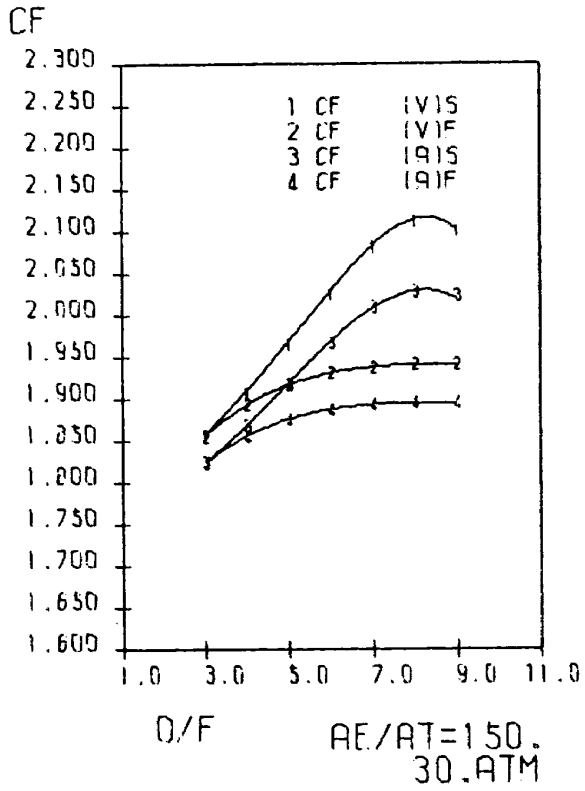
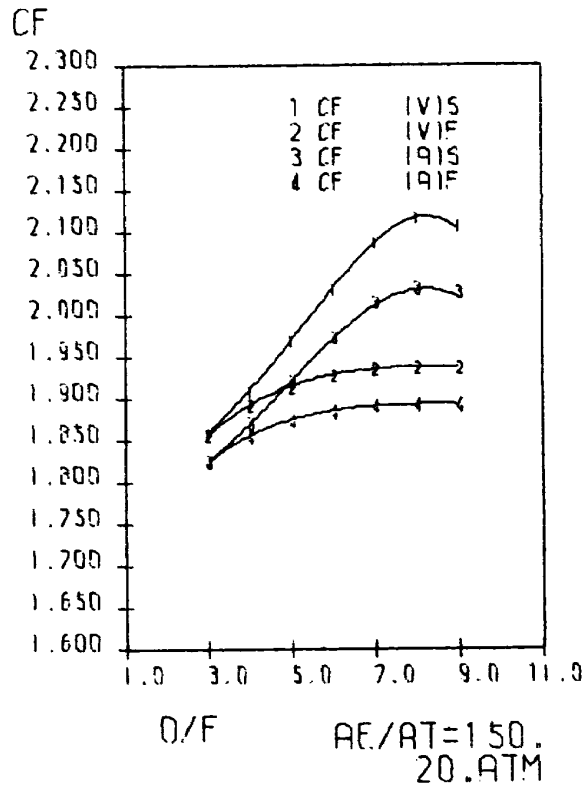


図 B 5 － 9

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







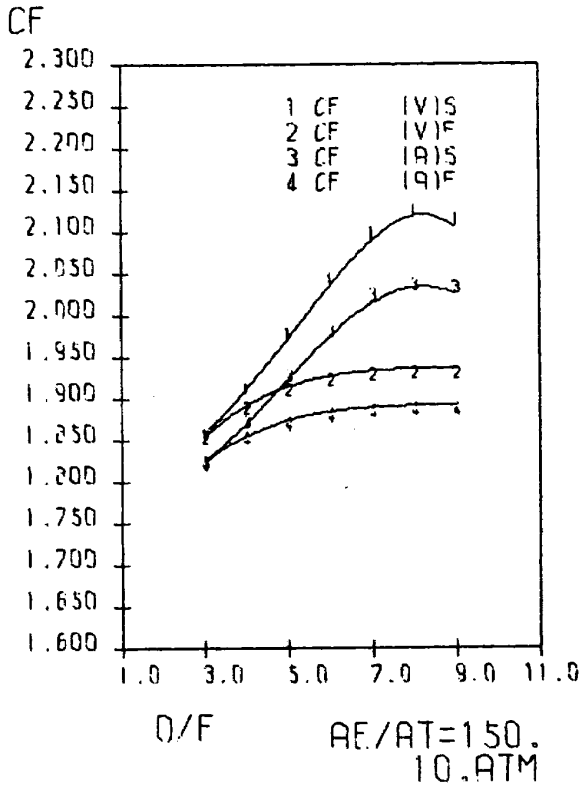
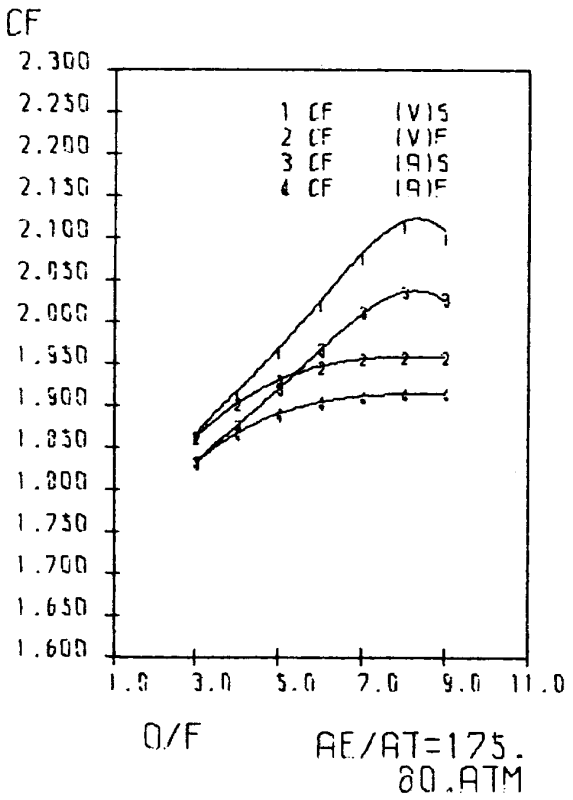
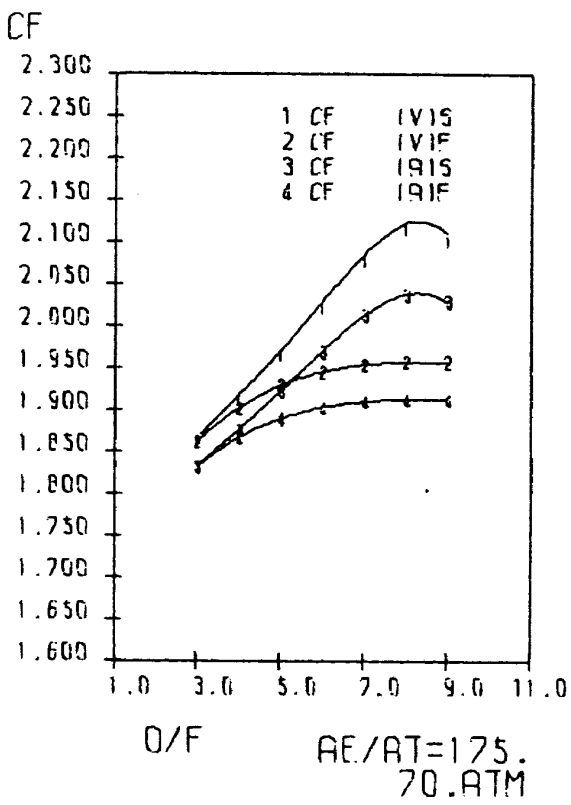
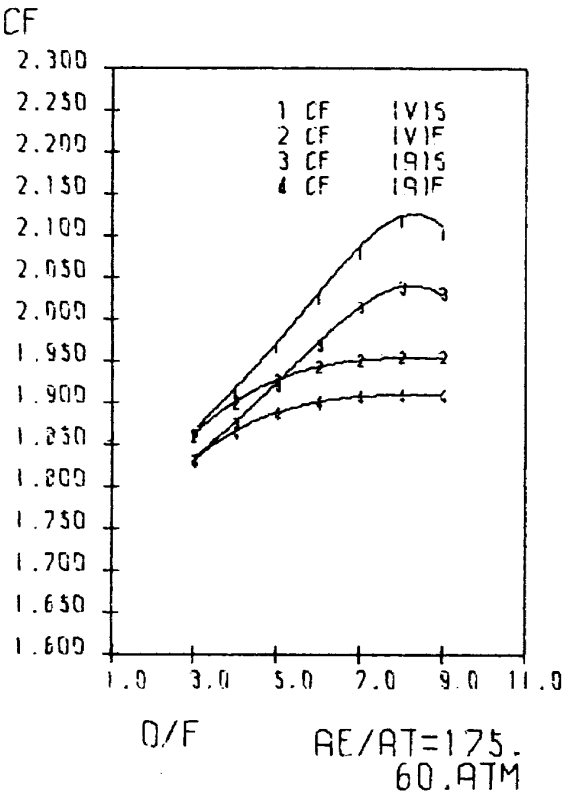


図 B 5−10

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







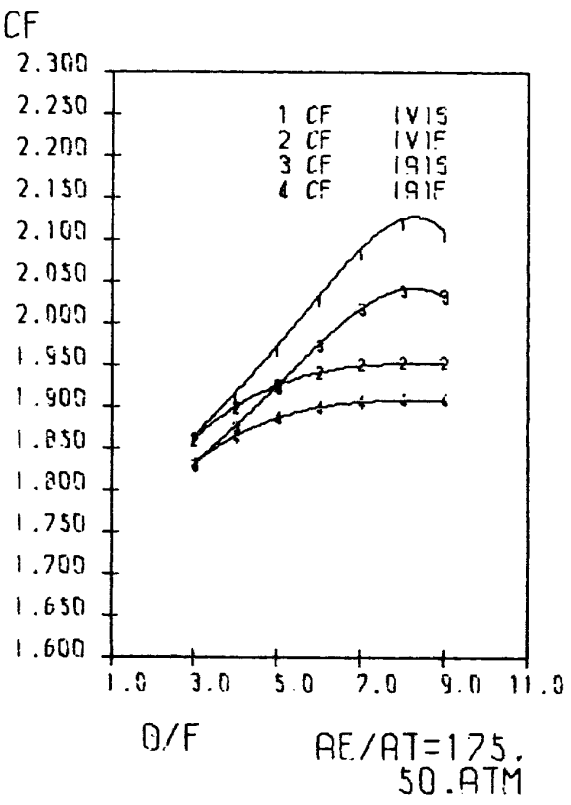
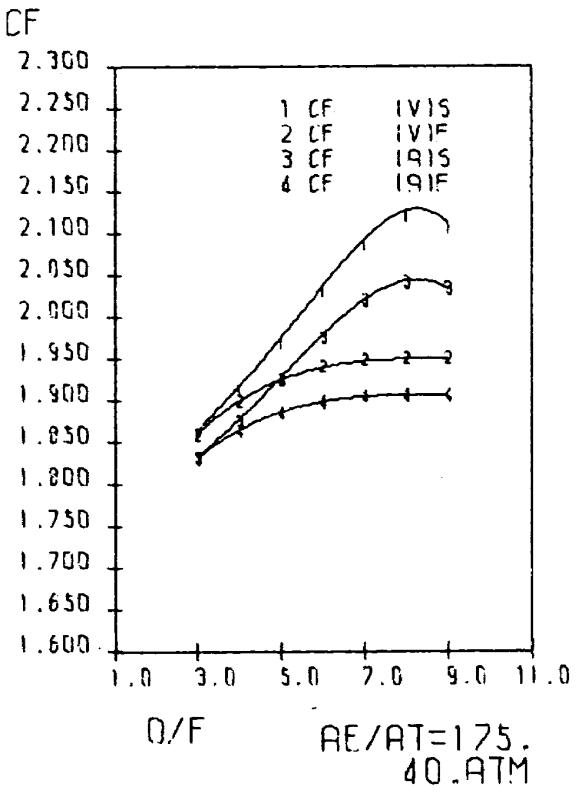
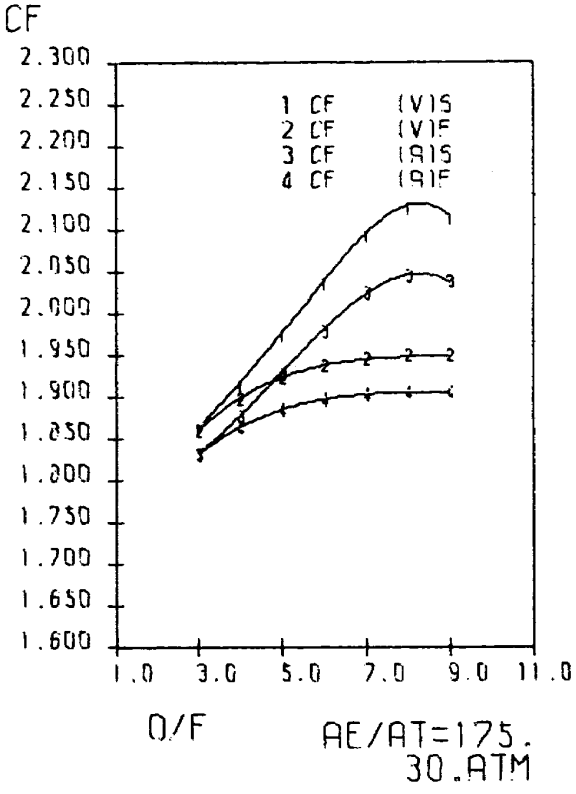
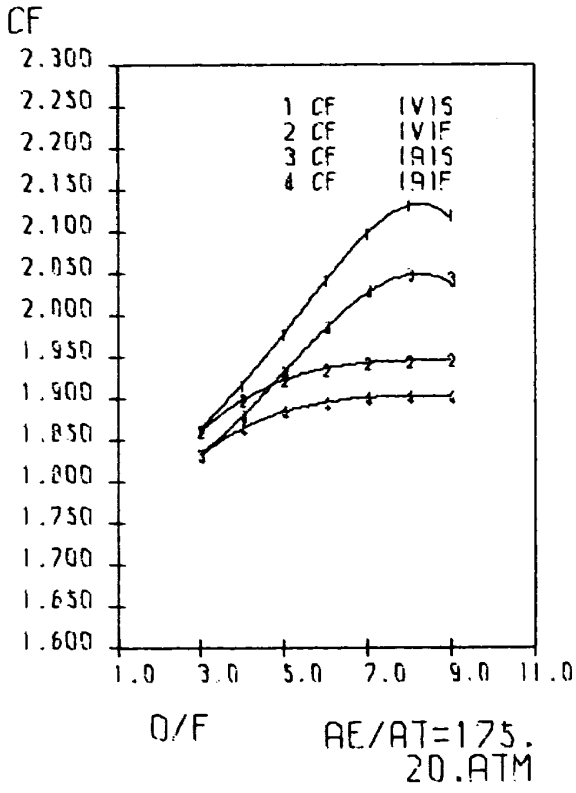


図 B 5−11

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







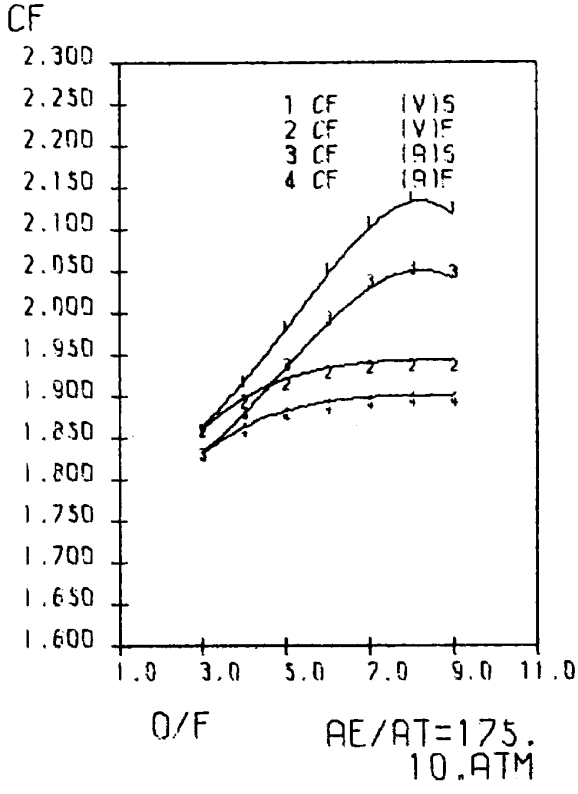
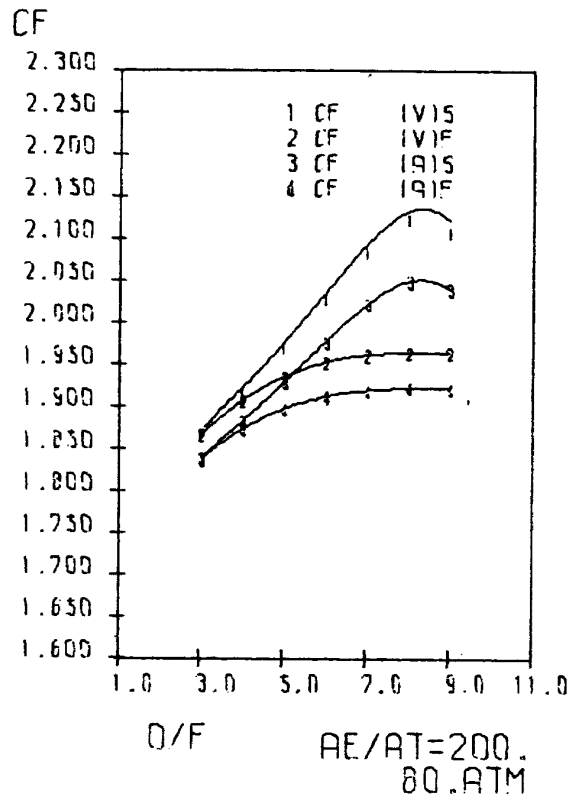
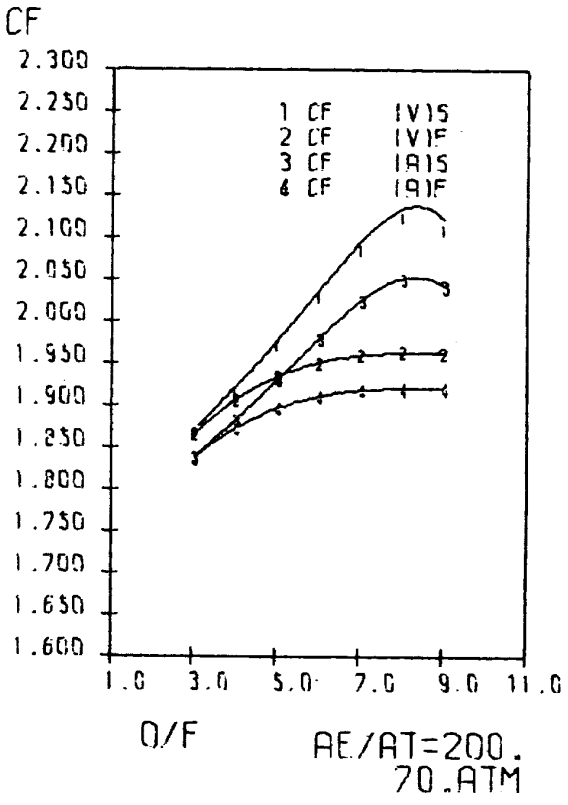
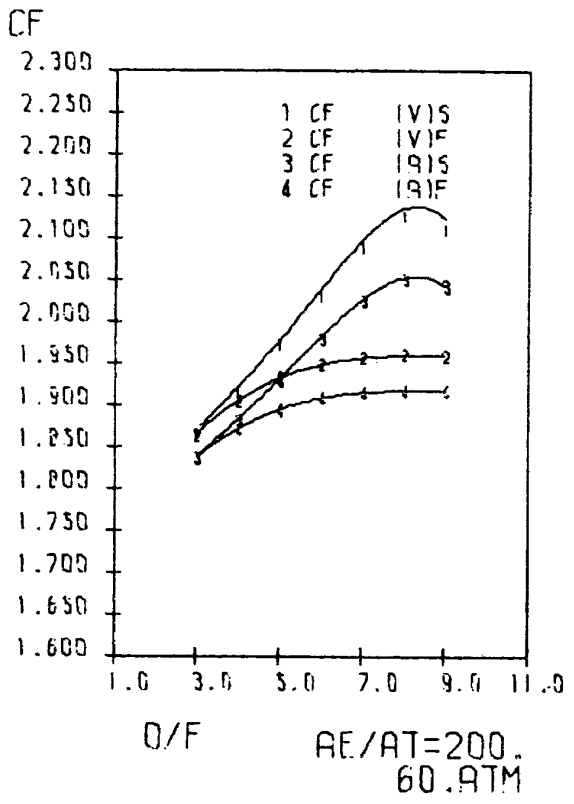


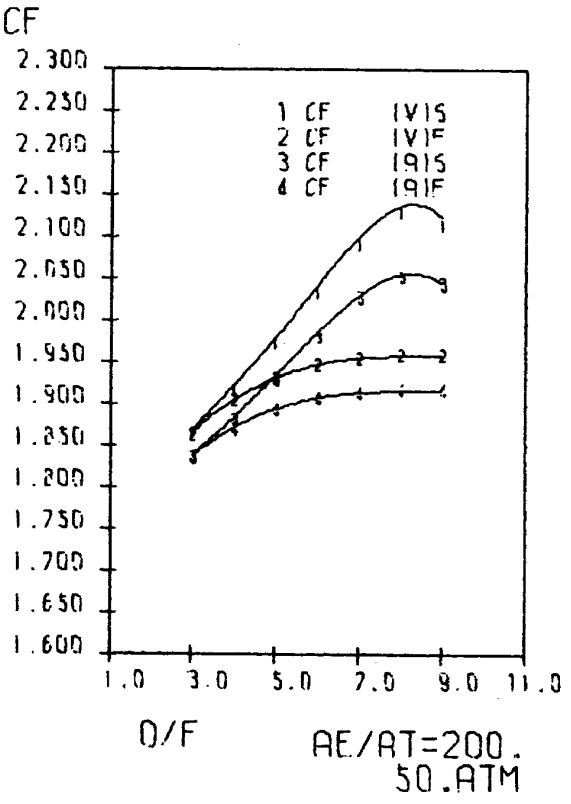
図 B 5−12

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



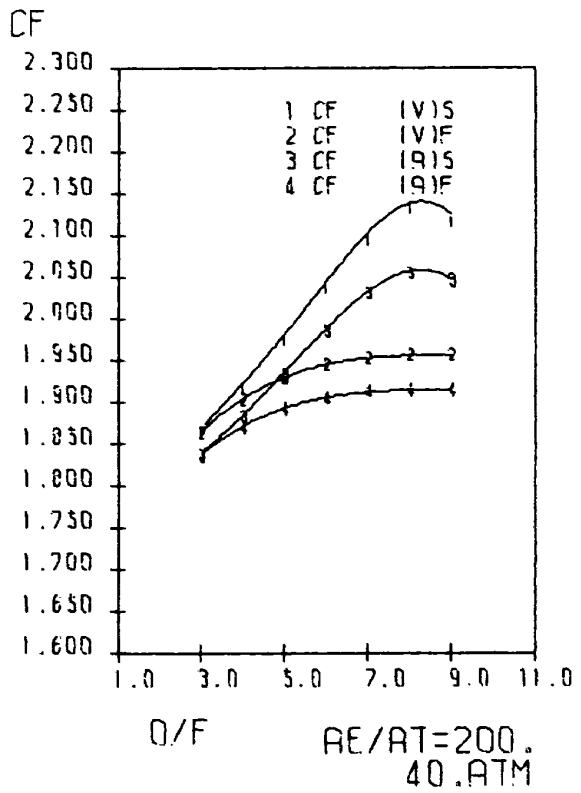


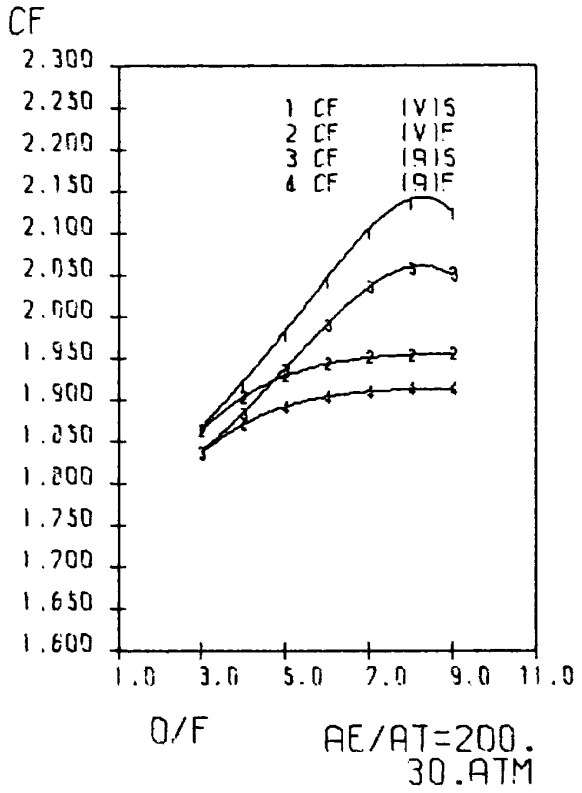


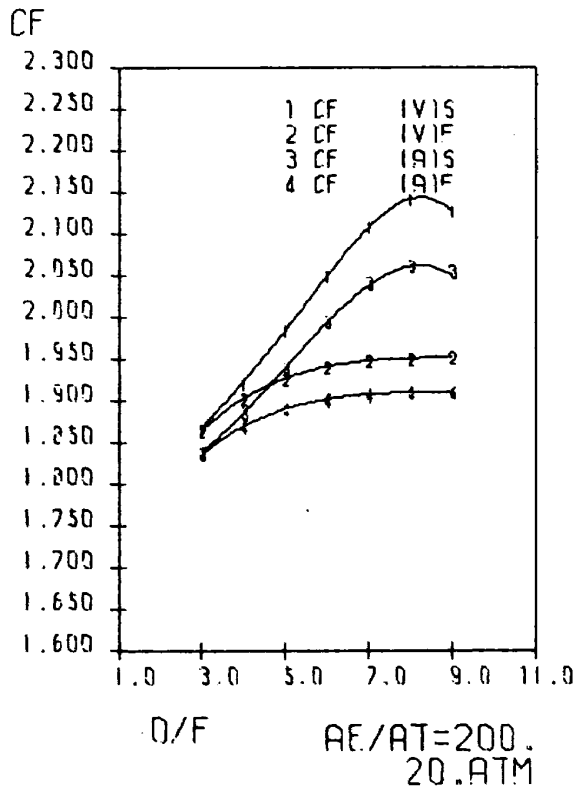


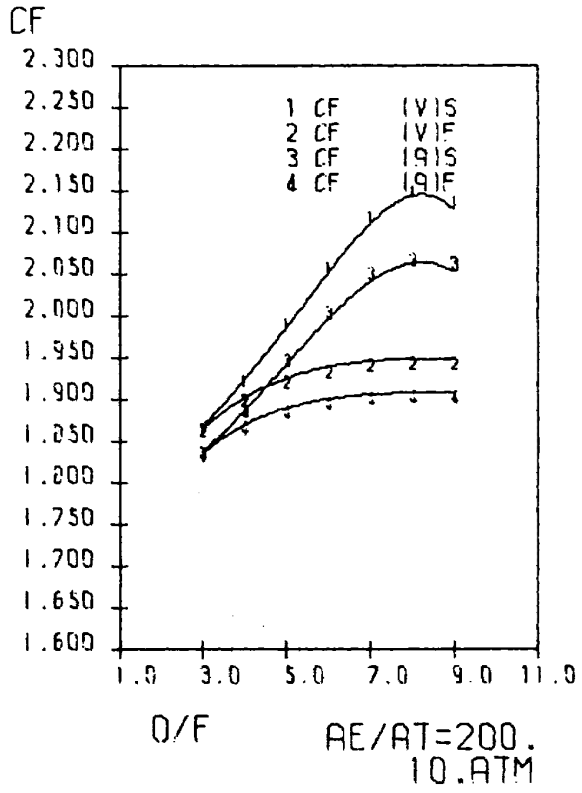
図B 5−13

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



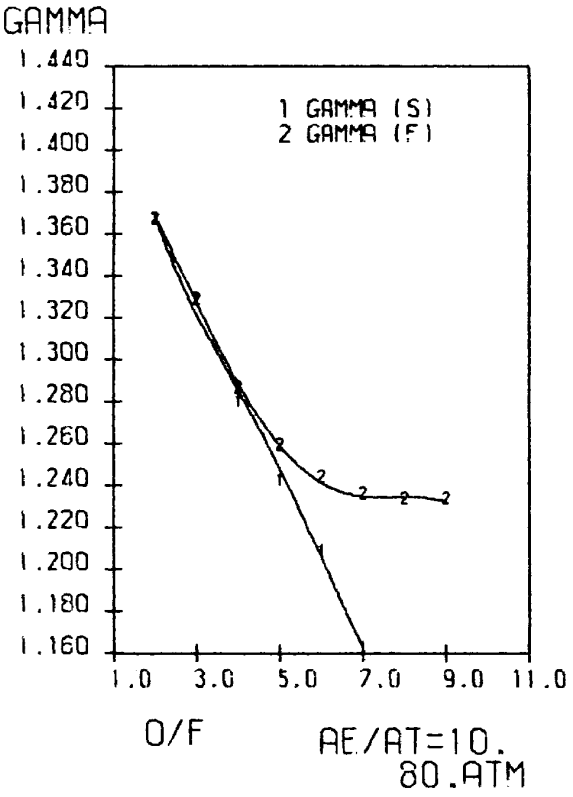


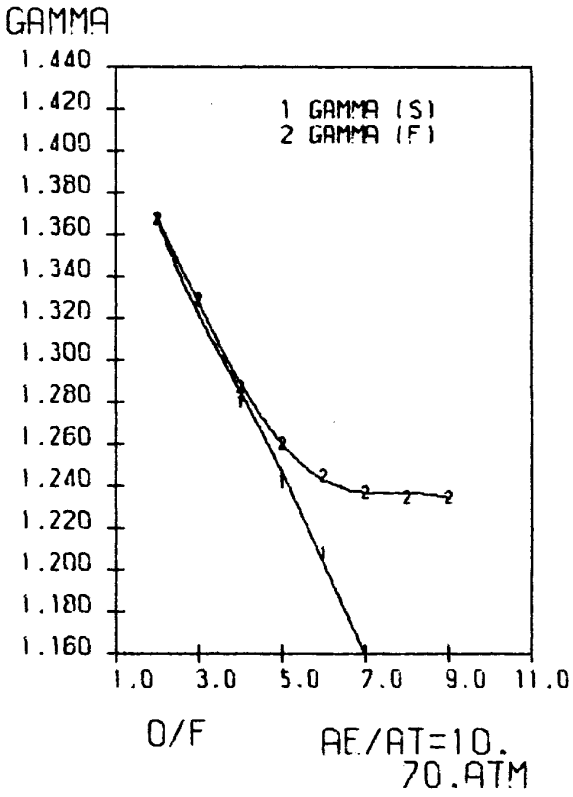


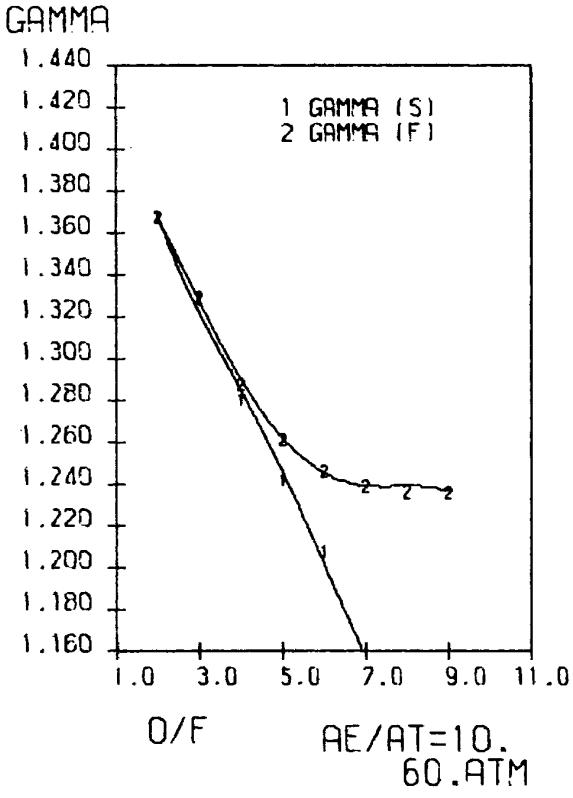


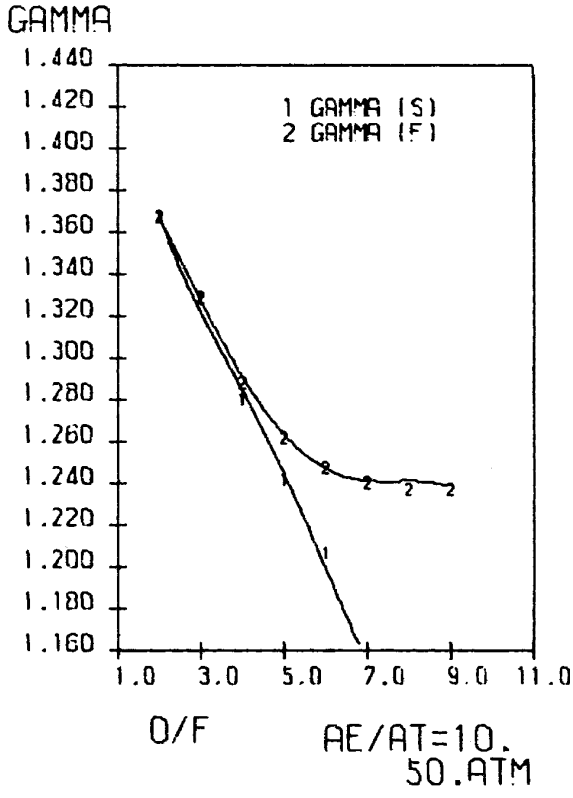
図B 5—14

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



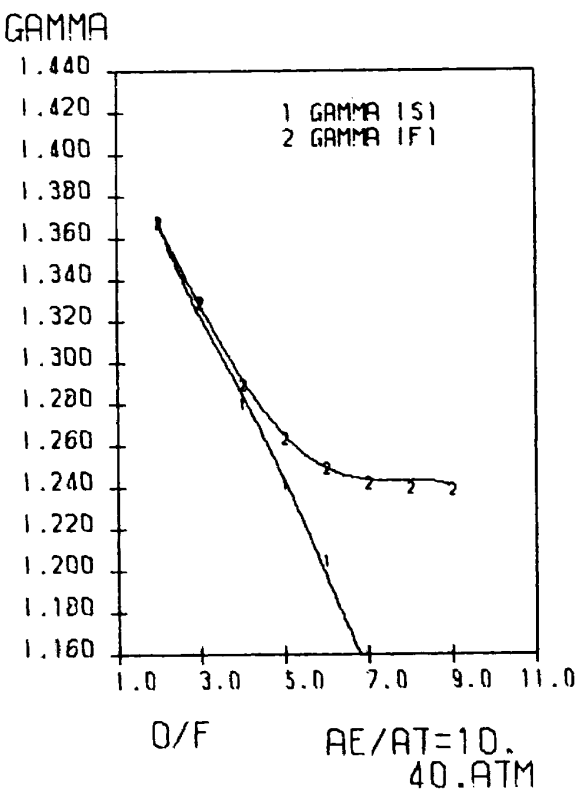


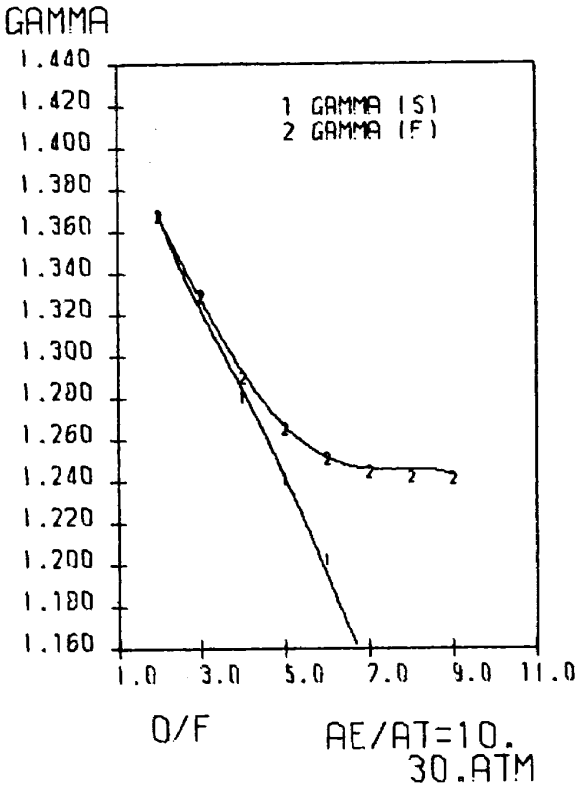


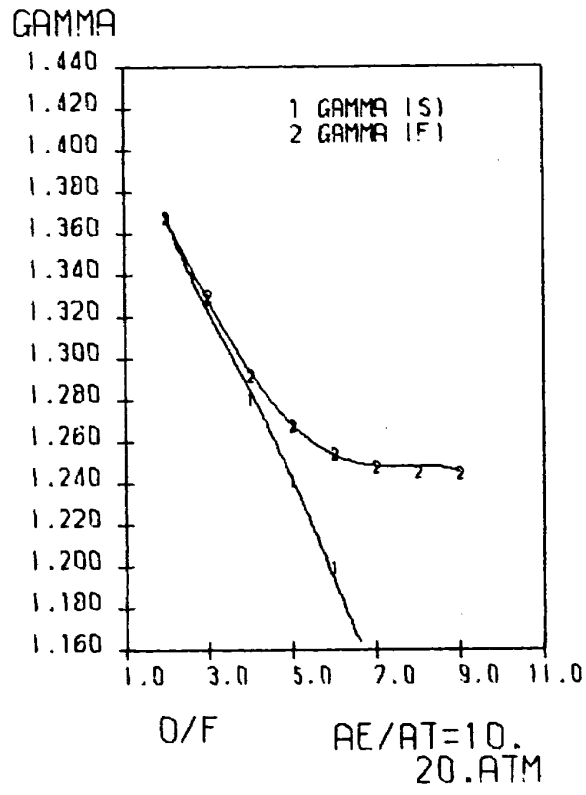


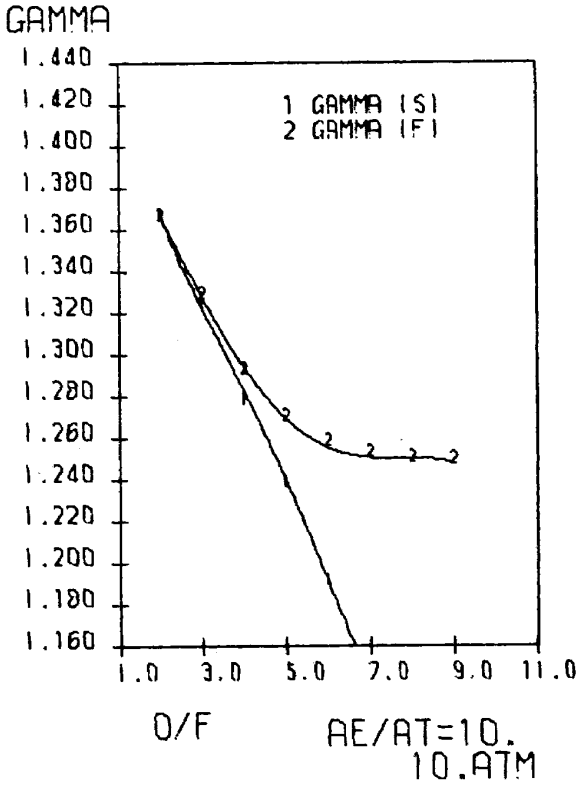
図B 6－1

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2134.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490



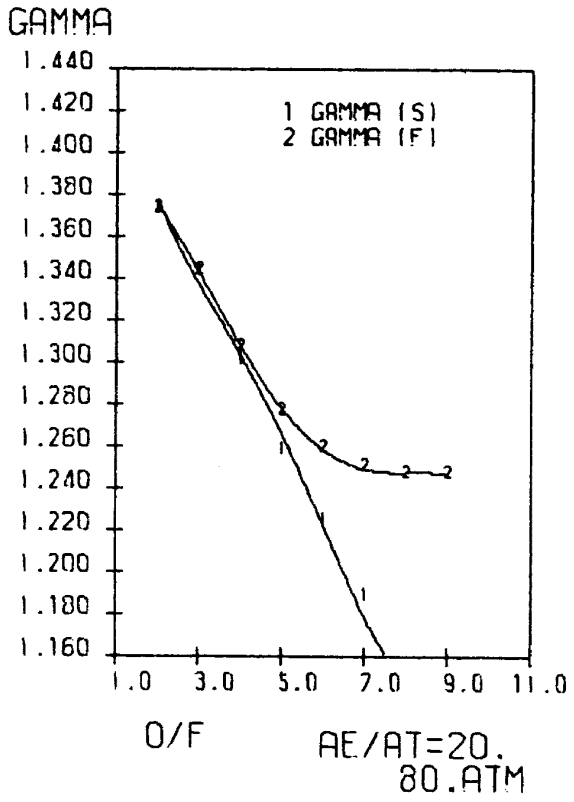


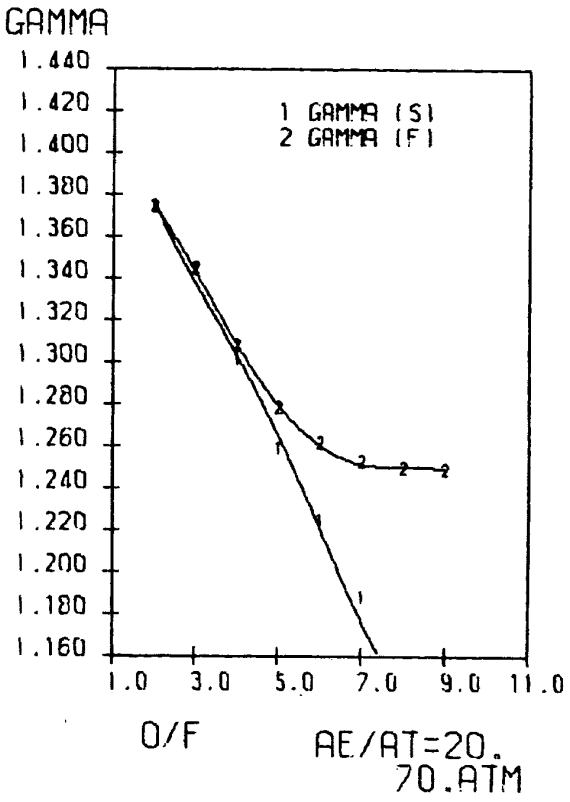


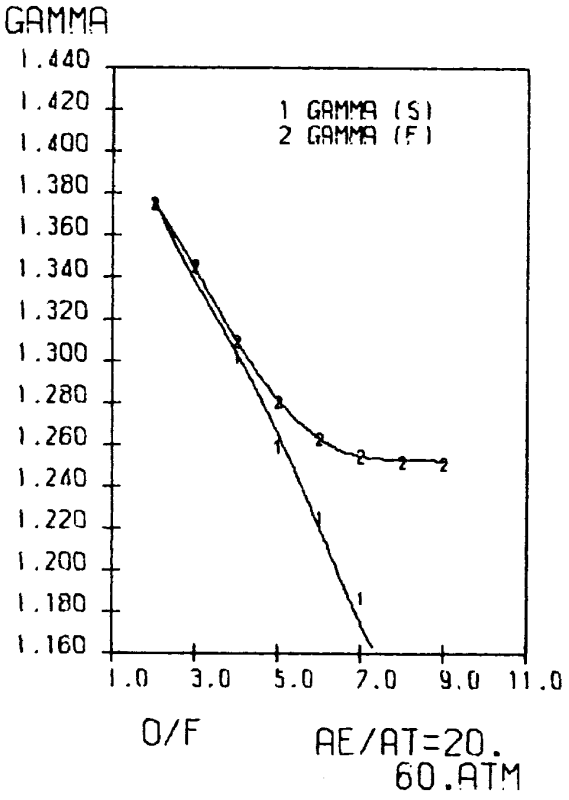


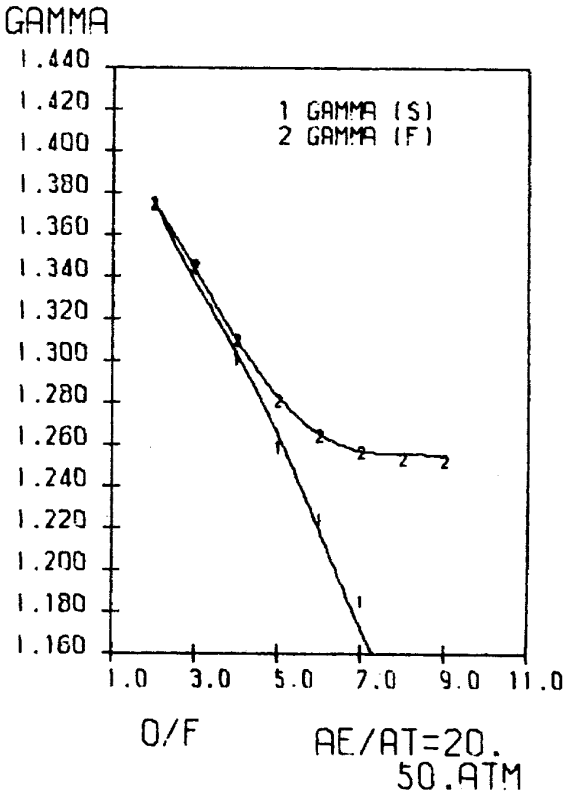
図B 6－2

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



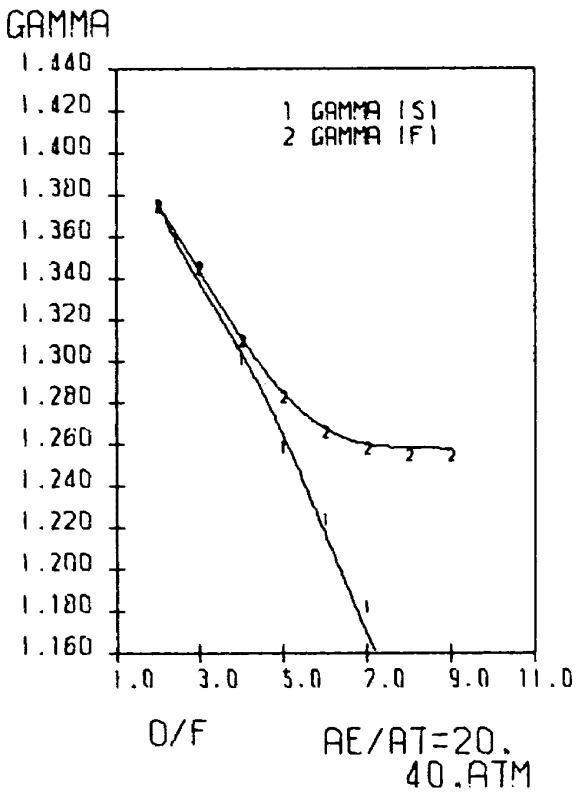


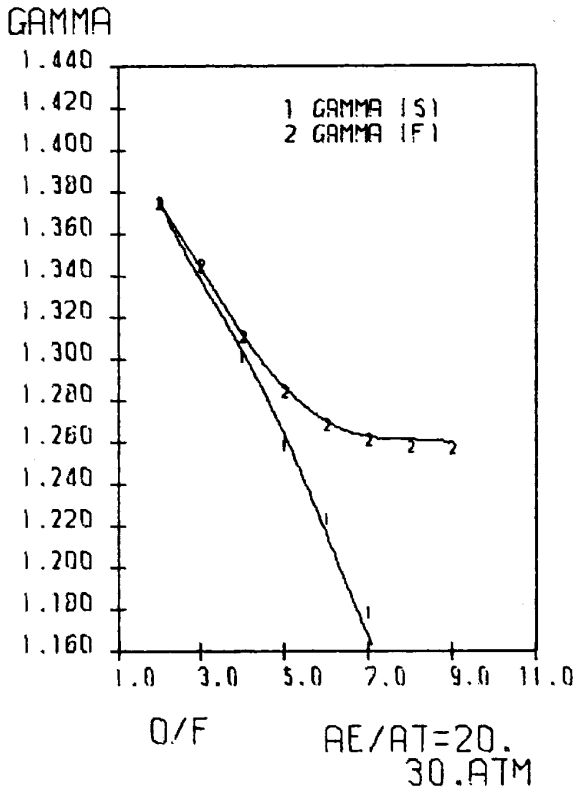


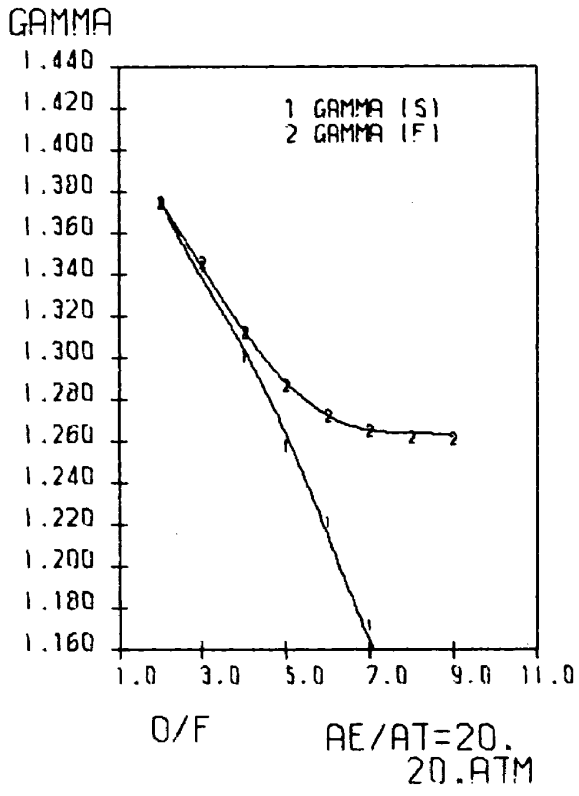


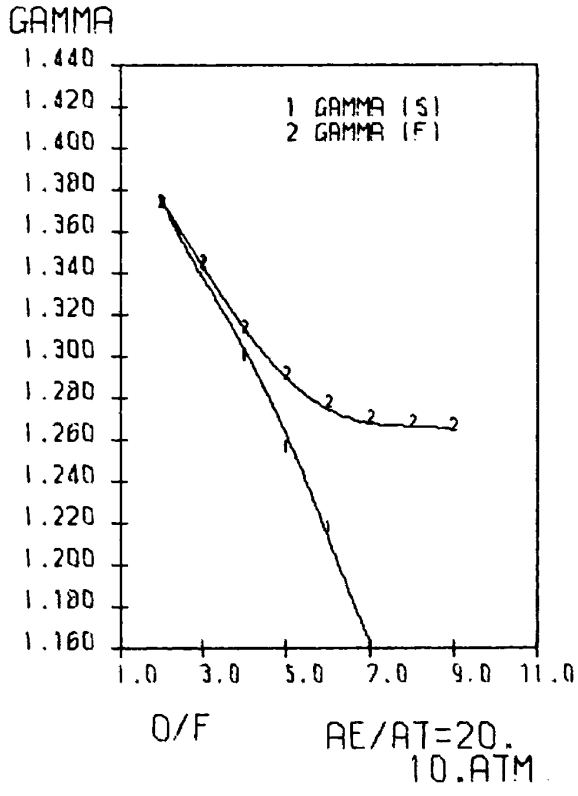
図B 6－3

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



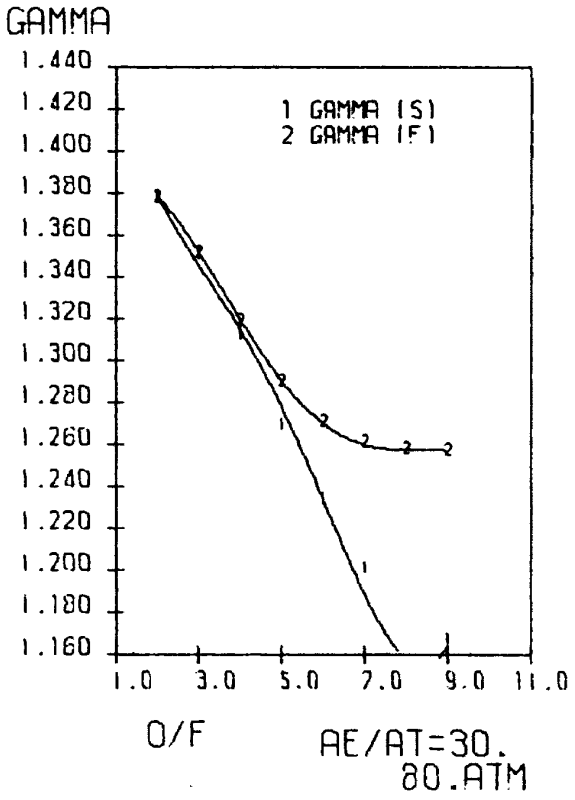


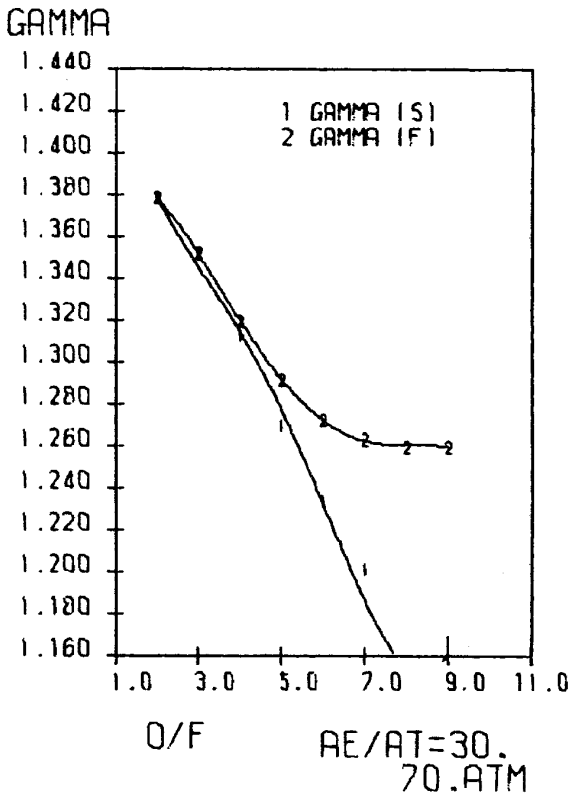


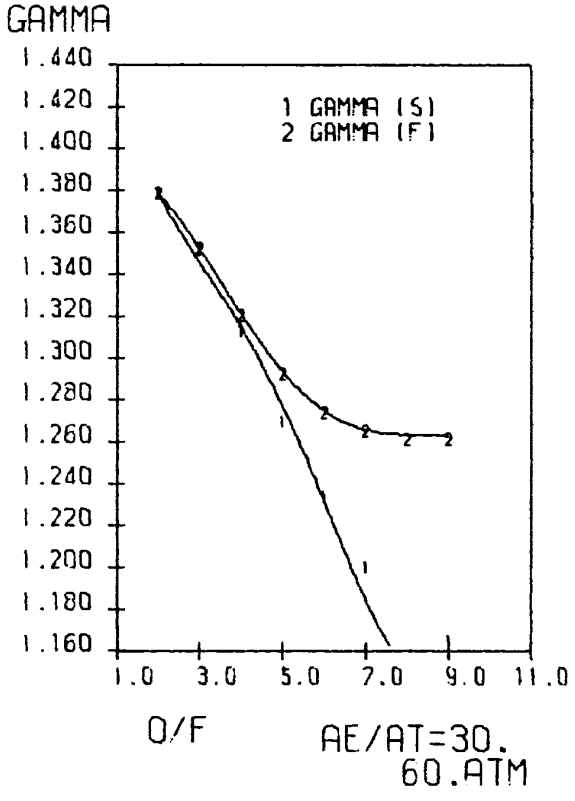


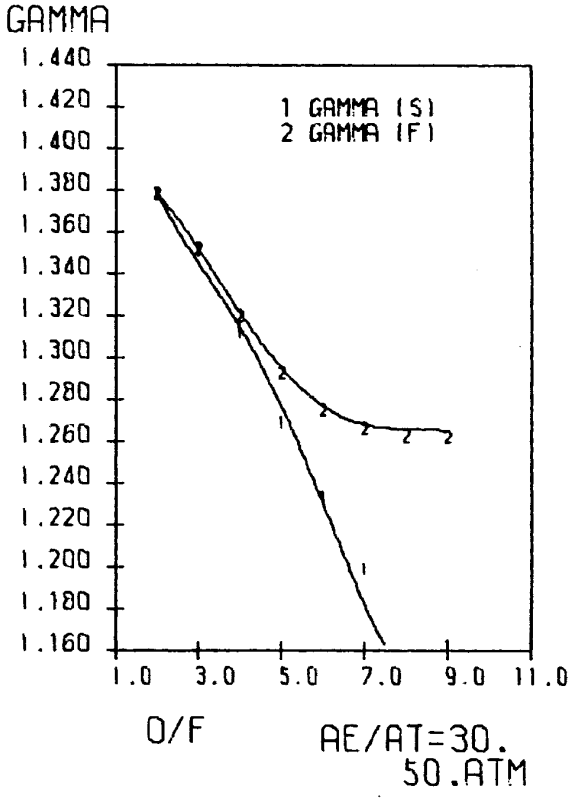
図B 6－4

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



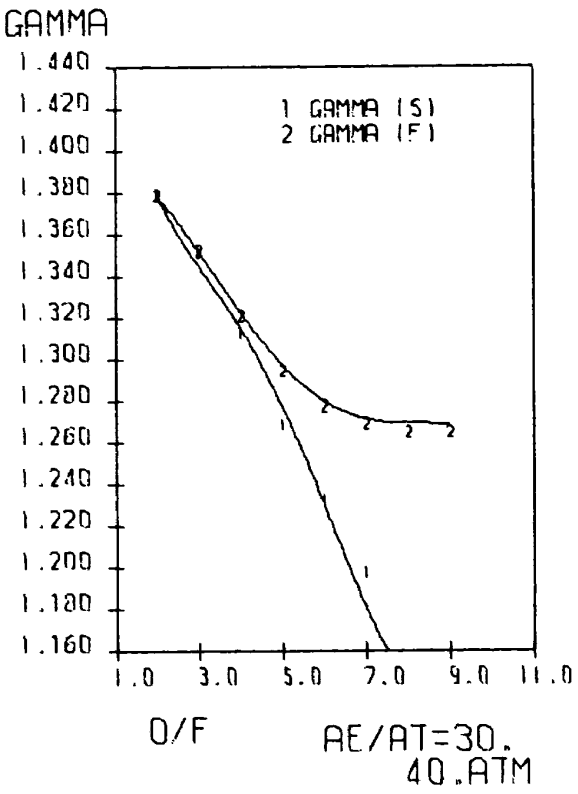


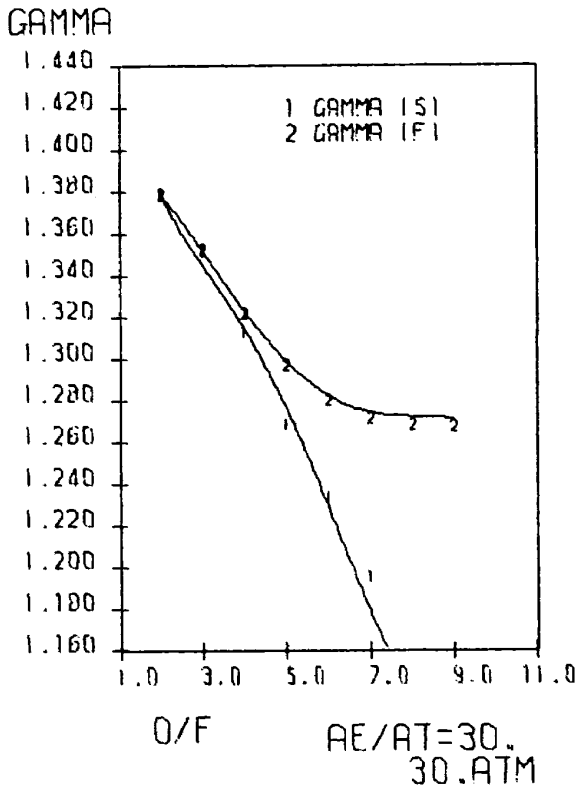


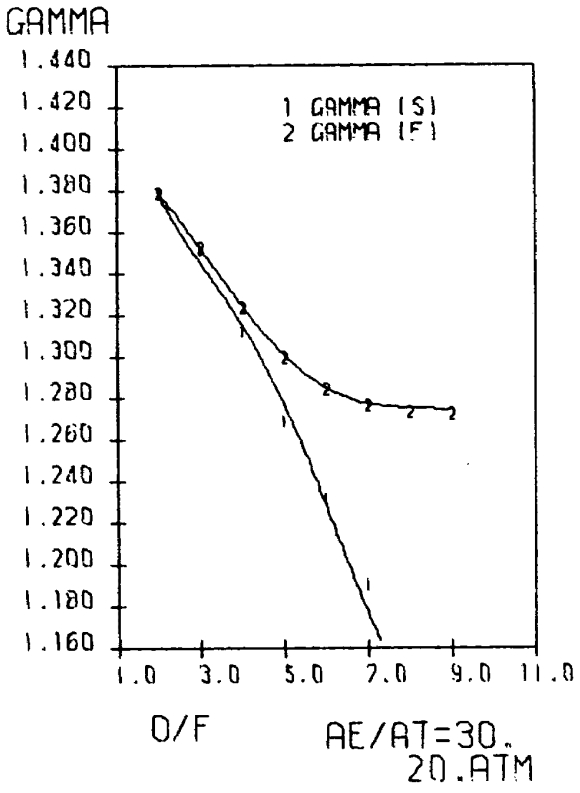


図B 6－5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







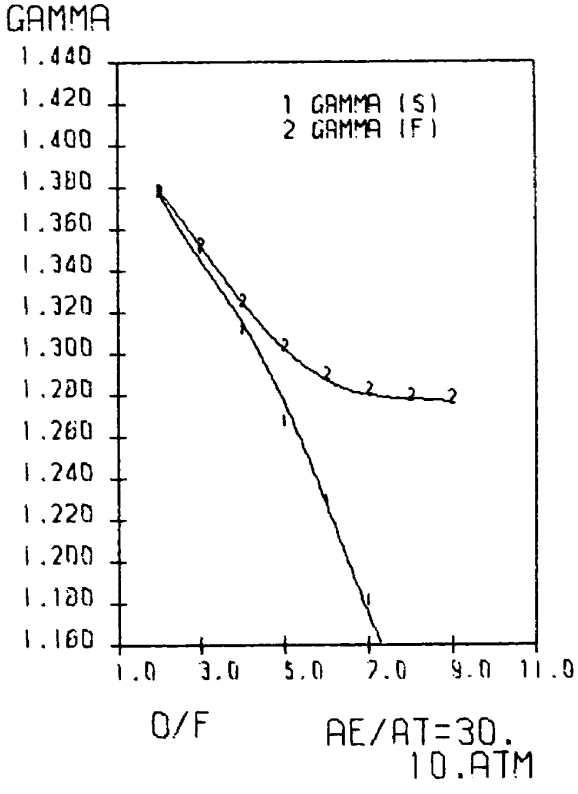
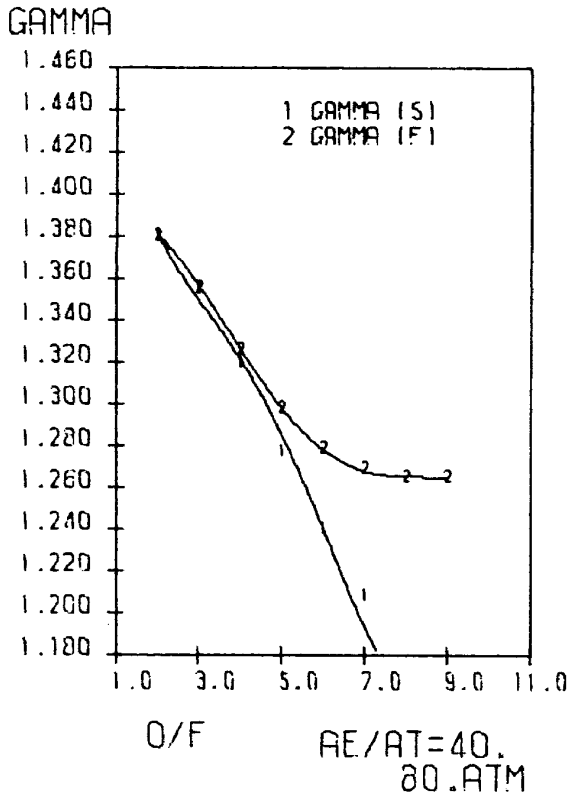
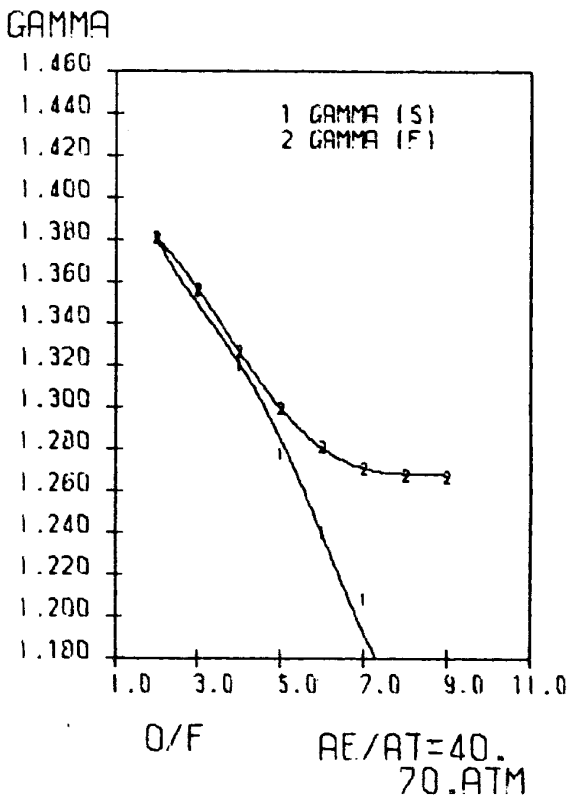
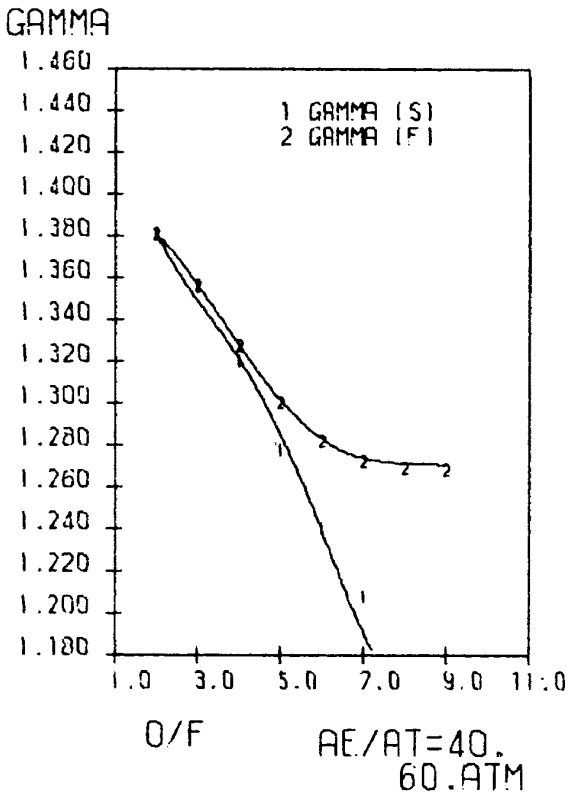


図 B 6－6

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







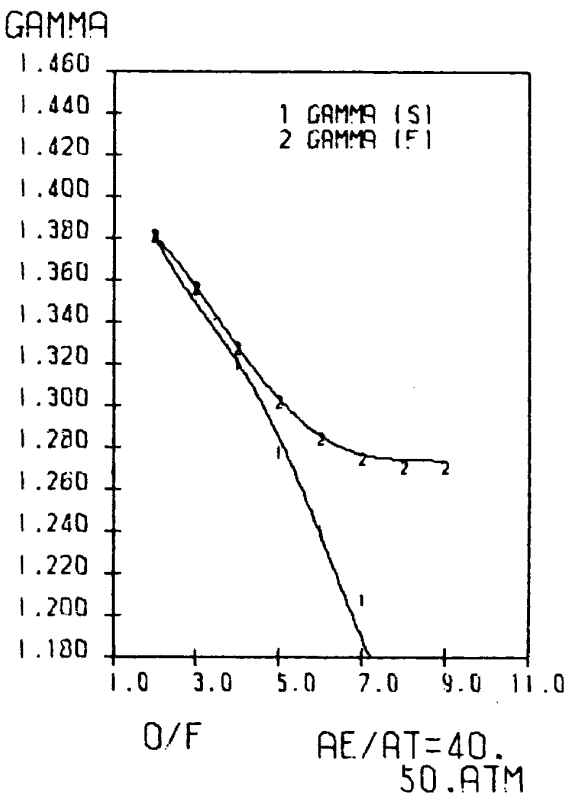
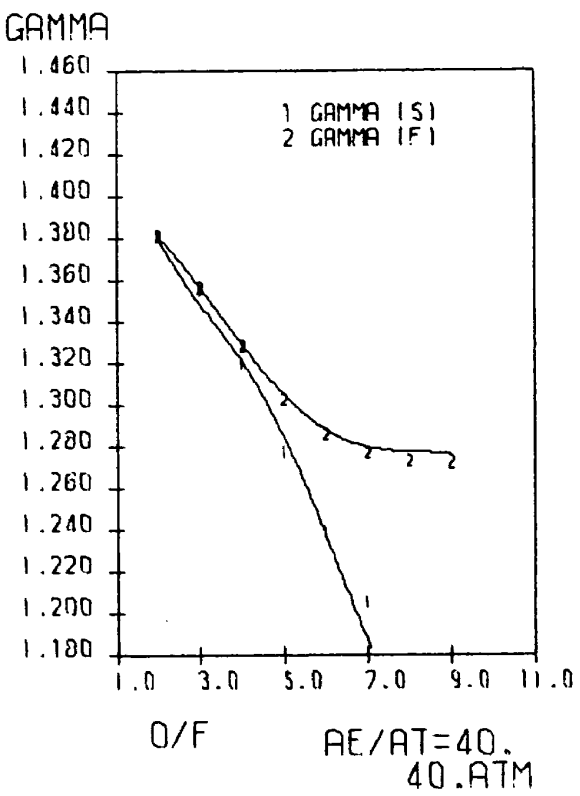
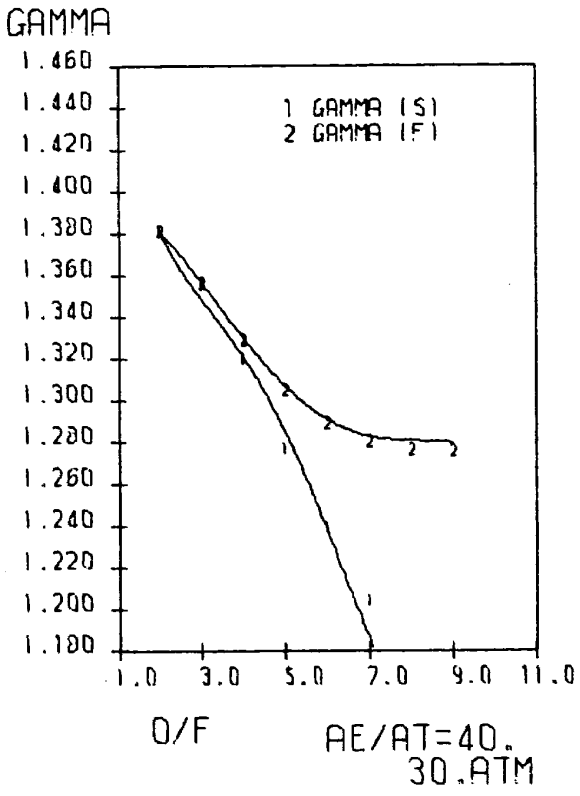
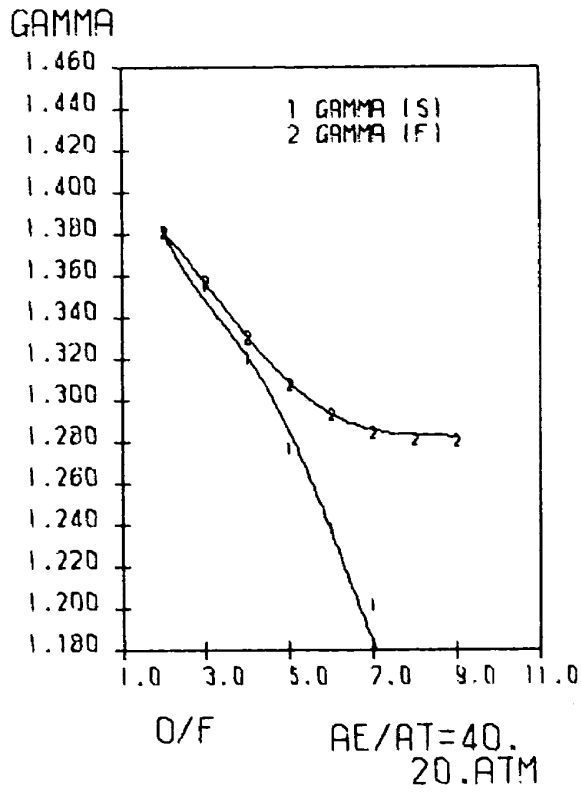


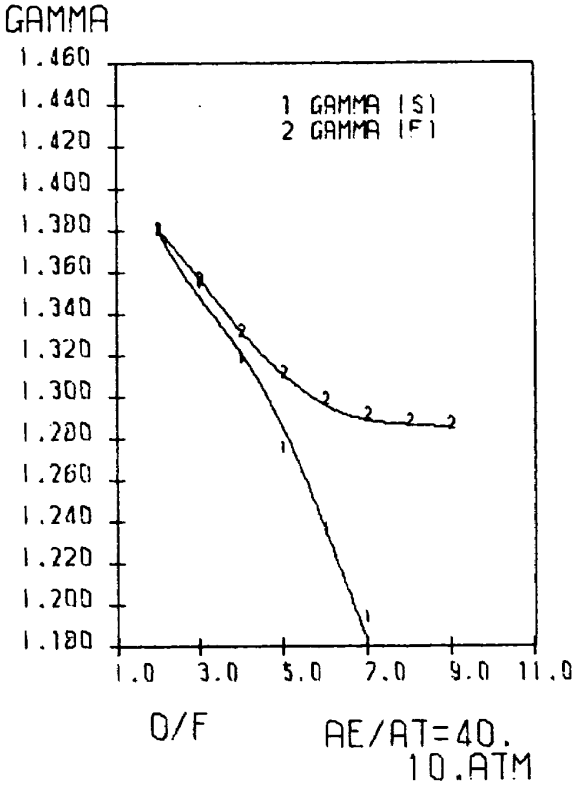
図 B. 6 — 7

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



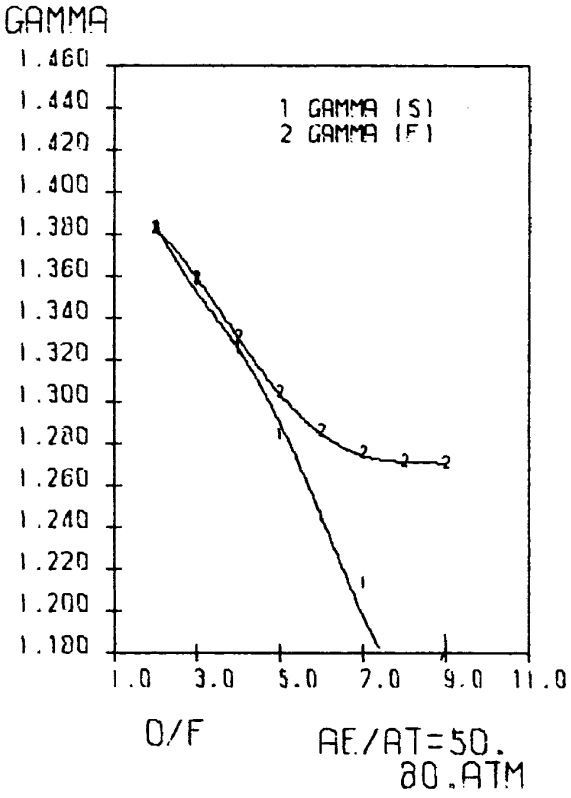


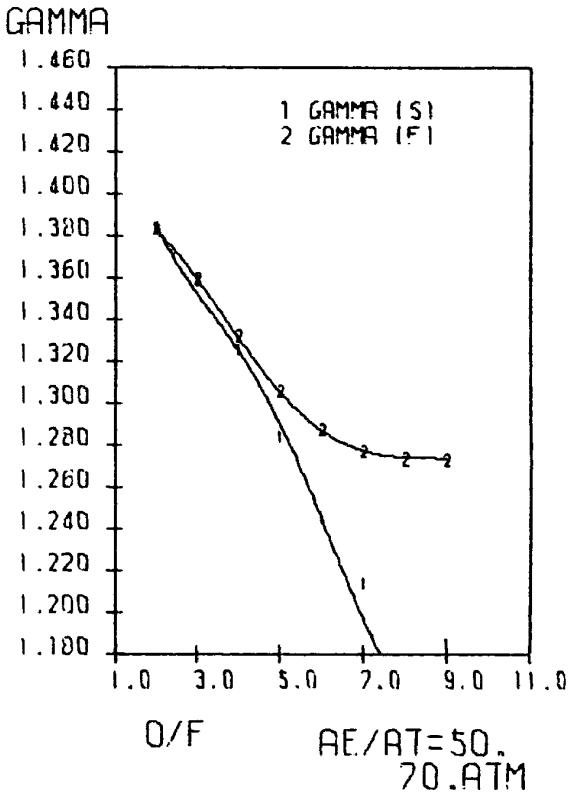


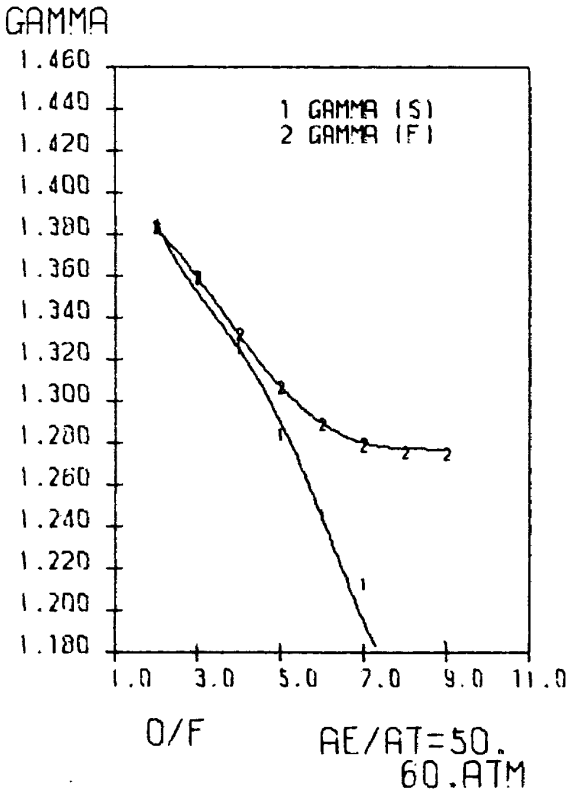


図B 6－8

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490







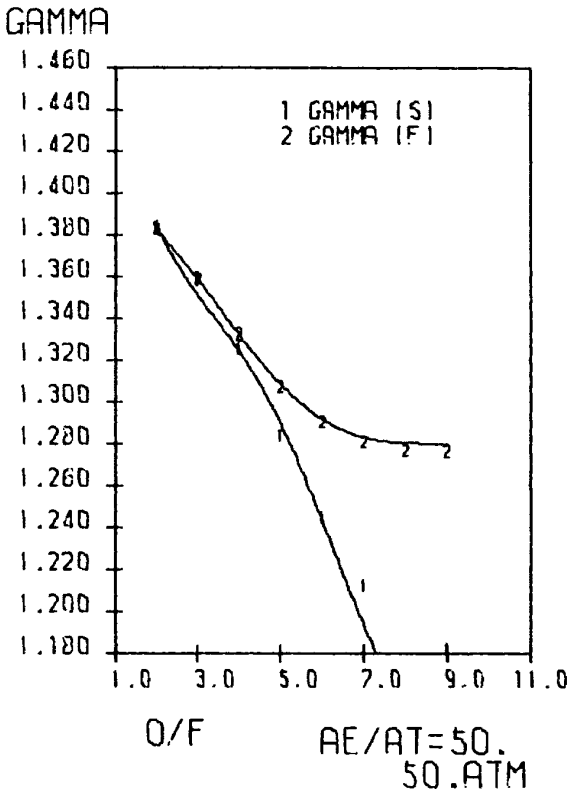
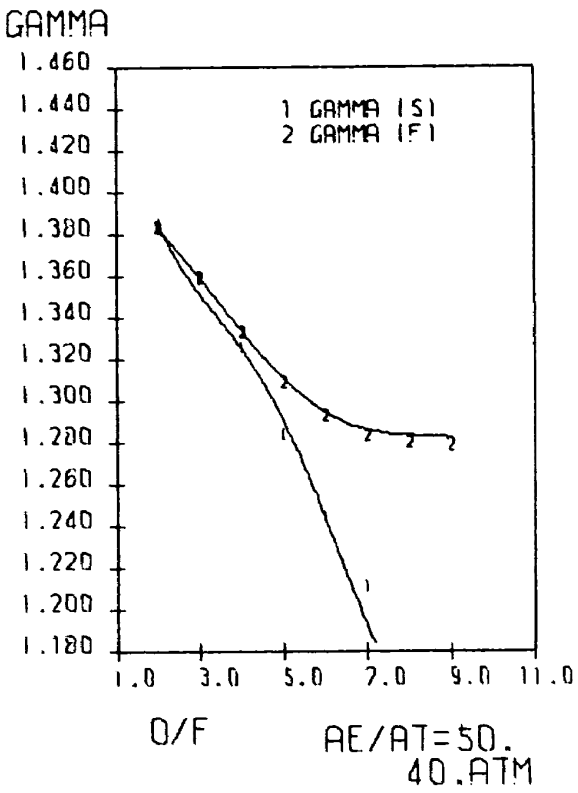
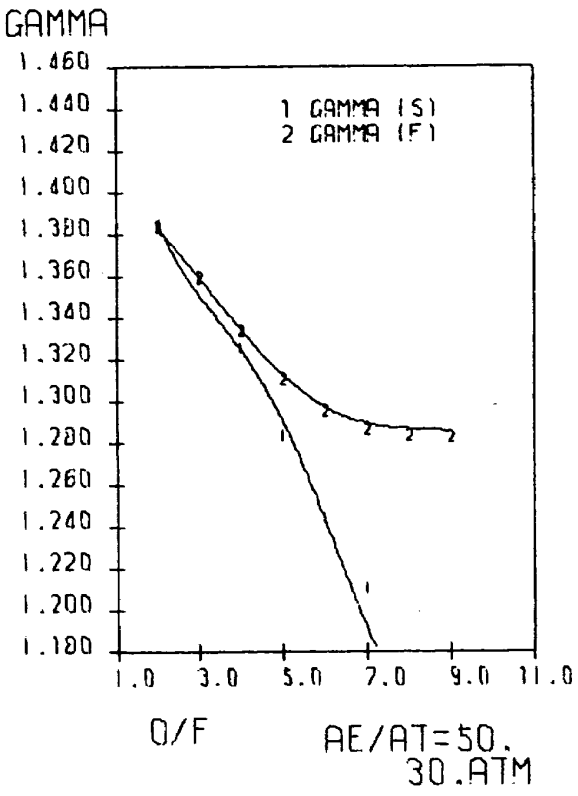
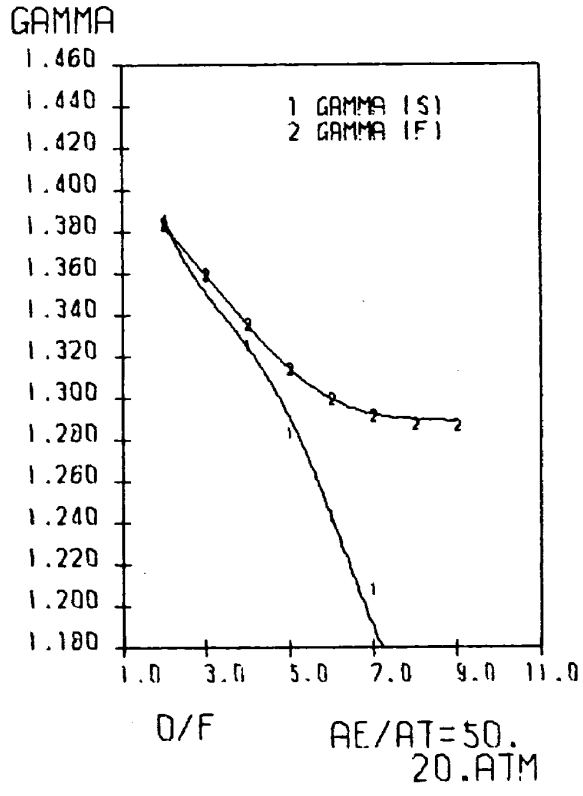


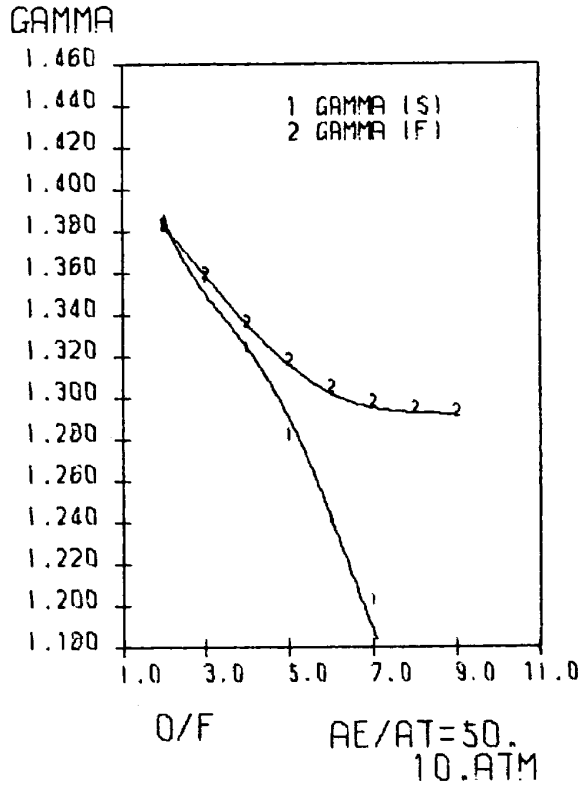
図 B 6－9

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



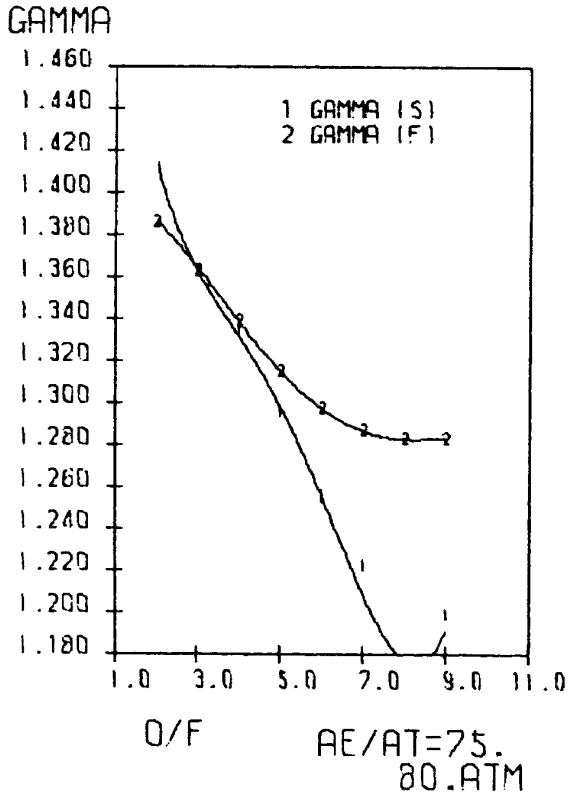


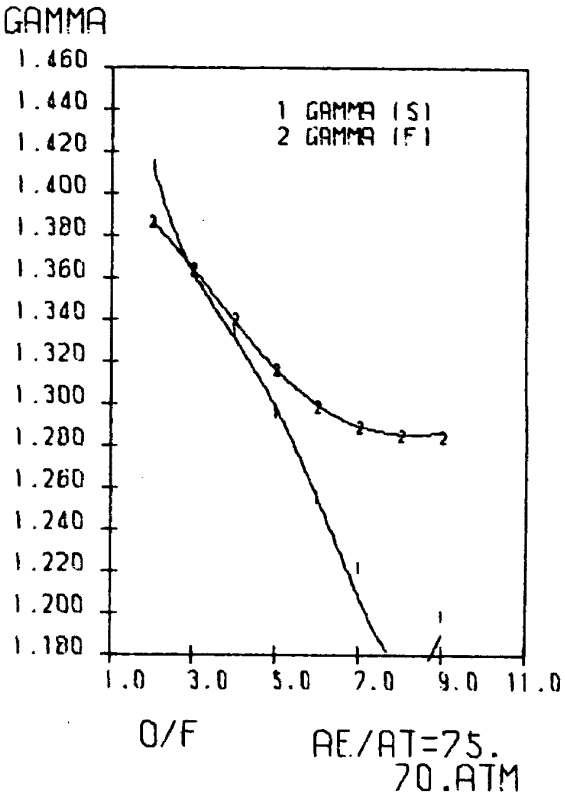


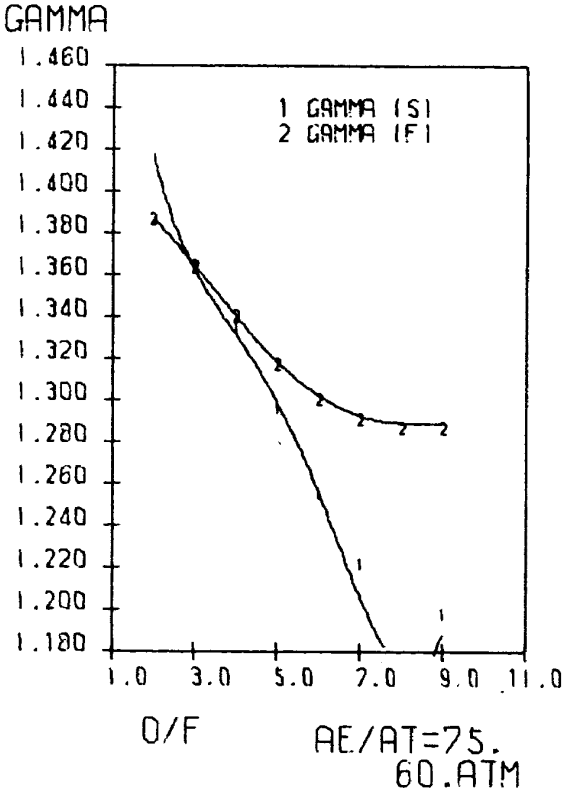


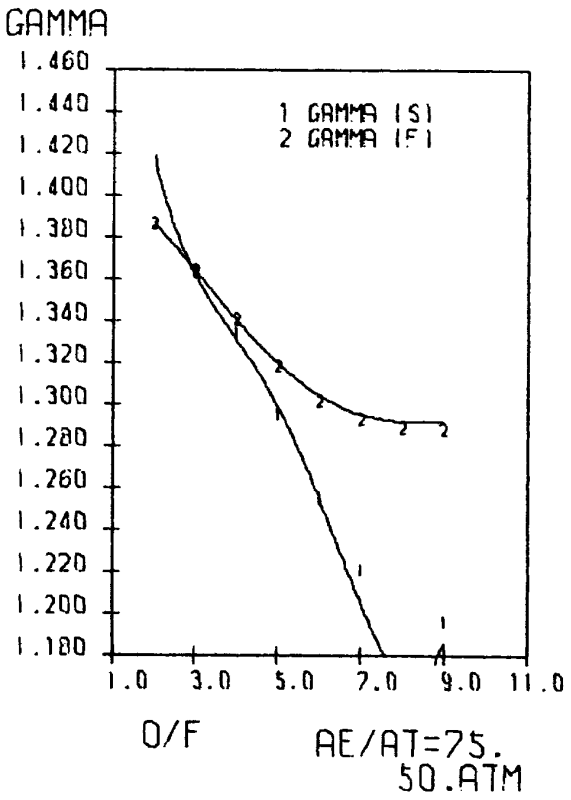
図B 6—10

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



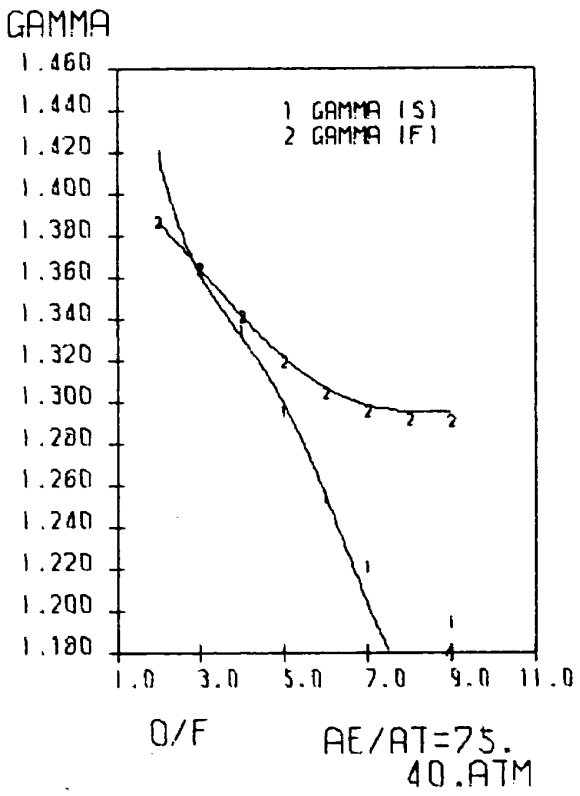


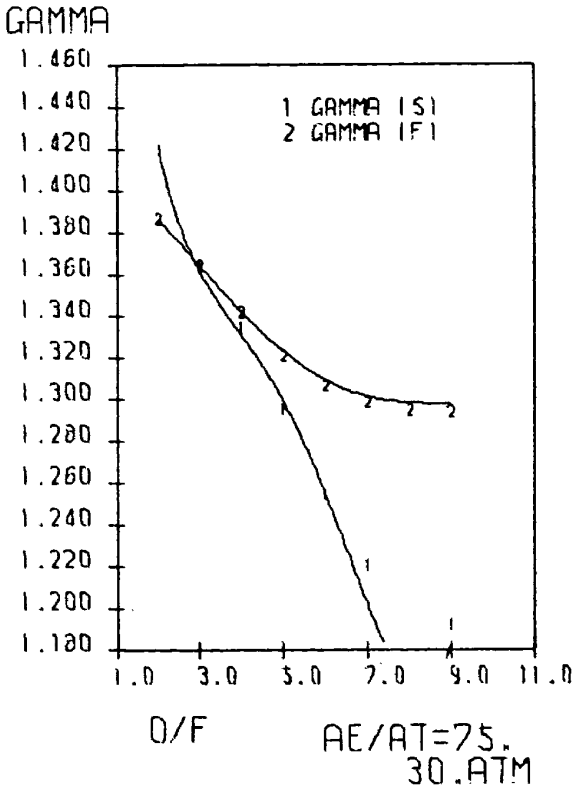


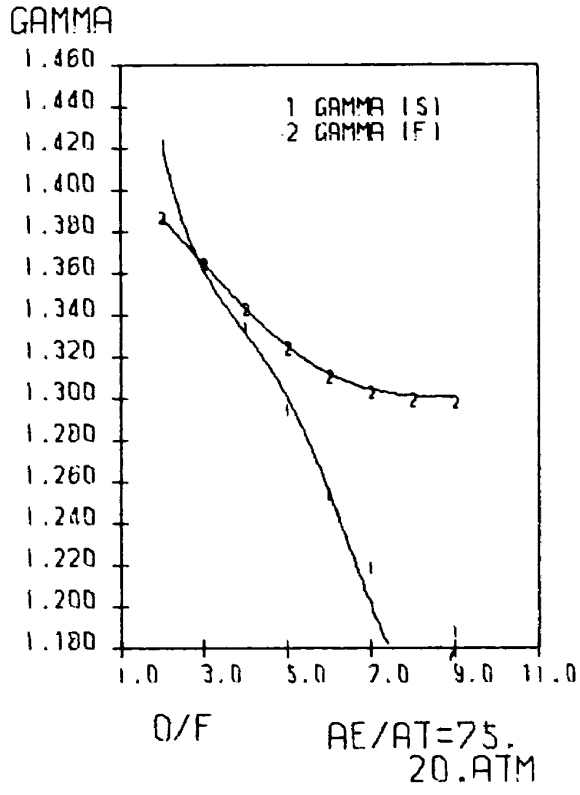


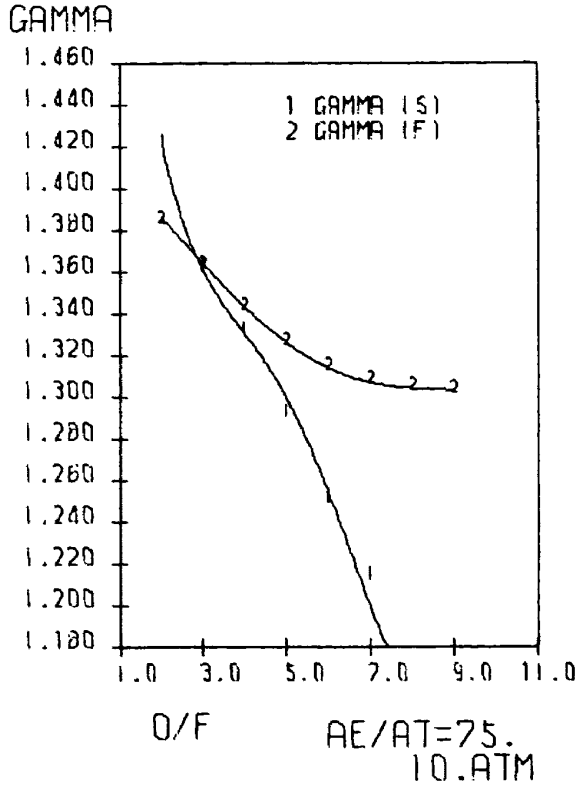
図B 6−11

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



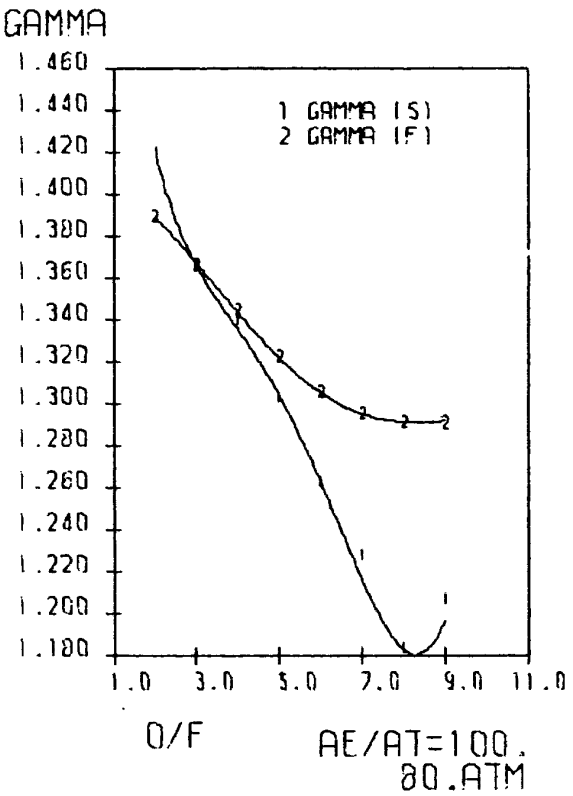


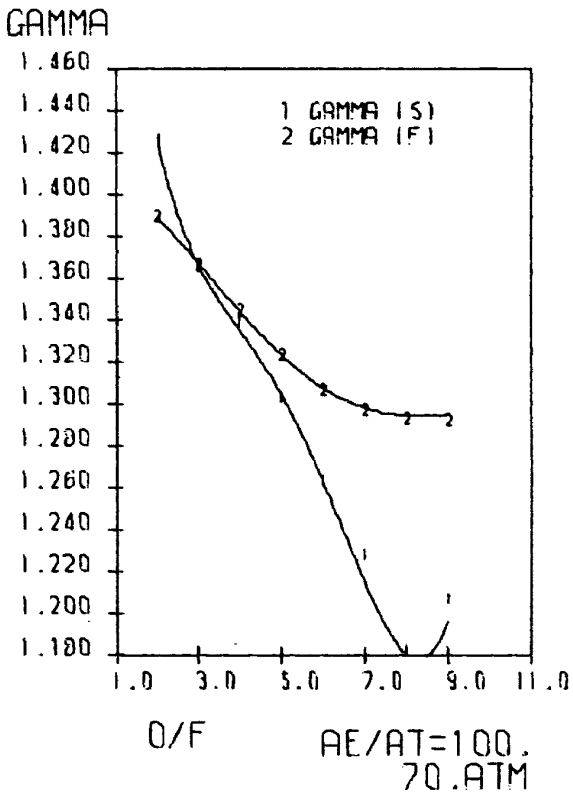


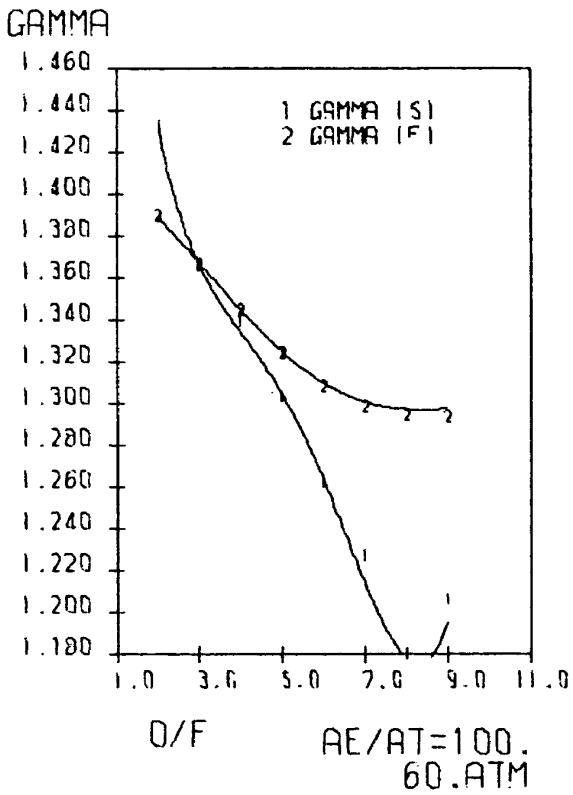


図B 6−12

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







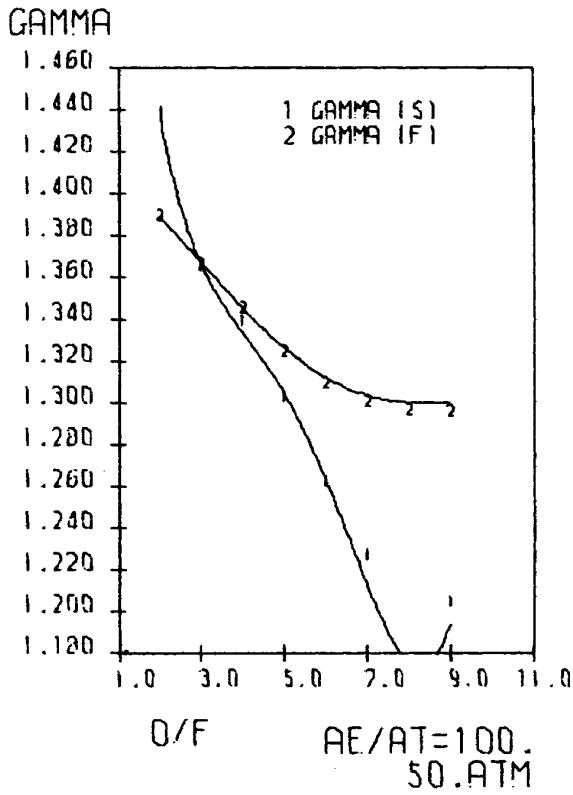


図 B 6−13

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490

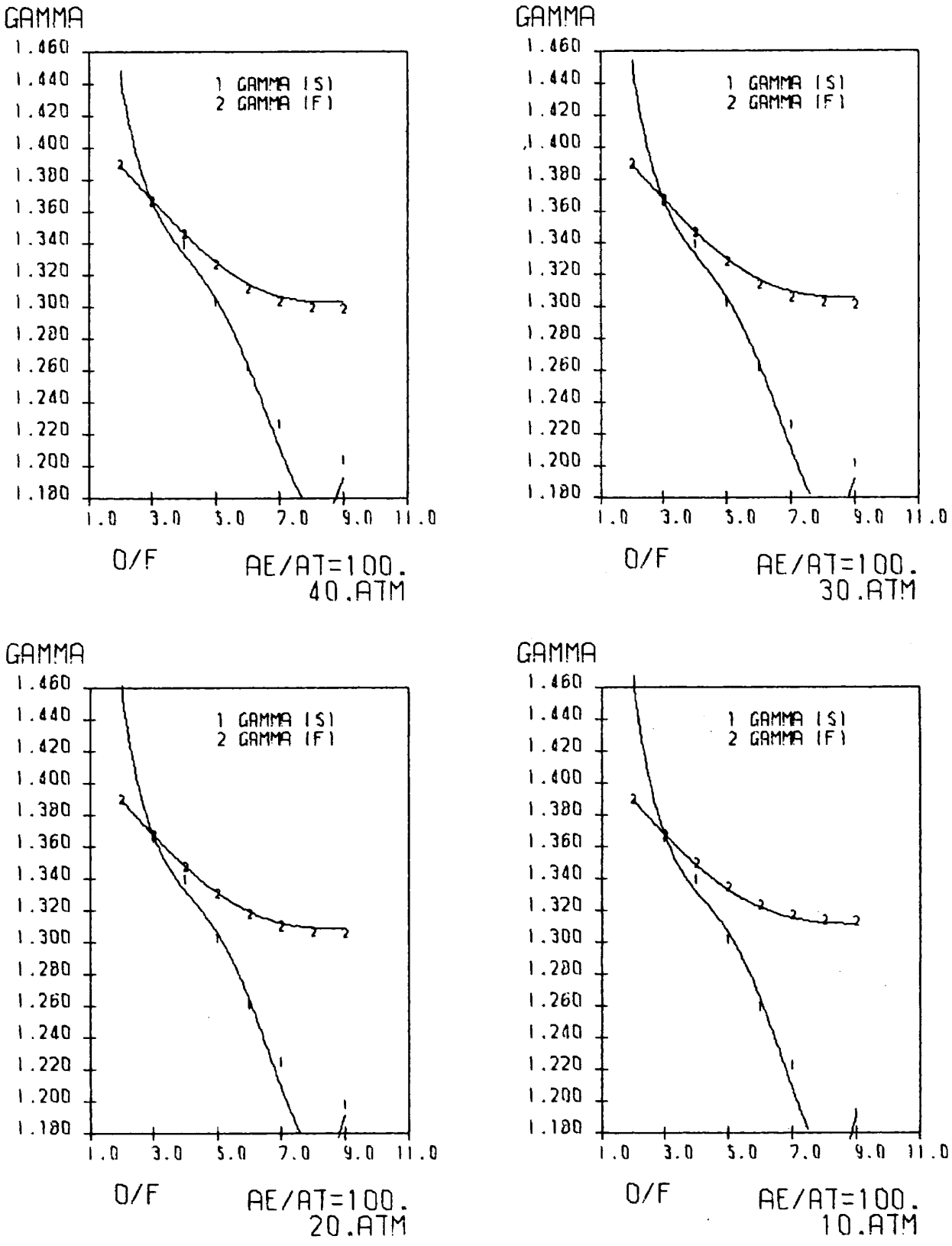
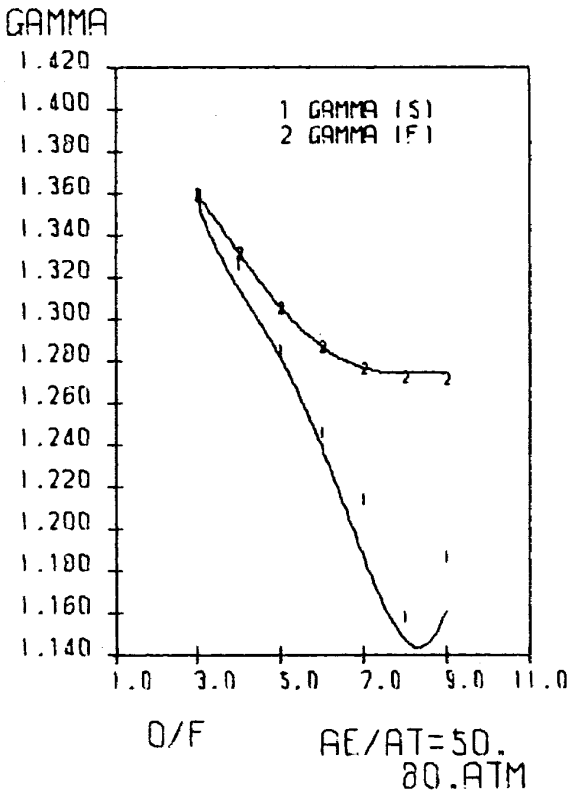
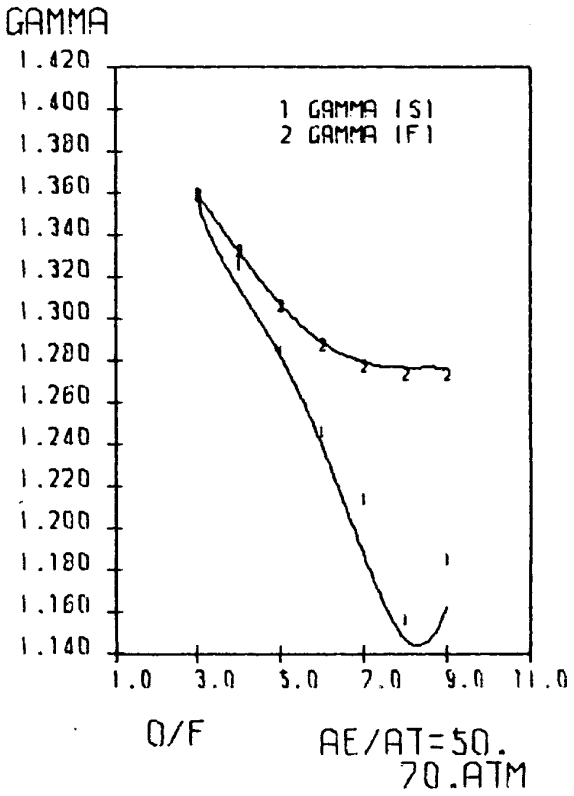
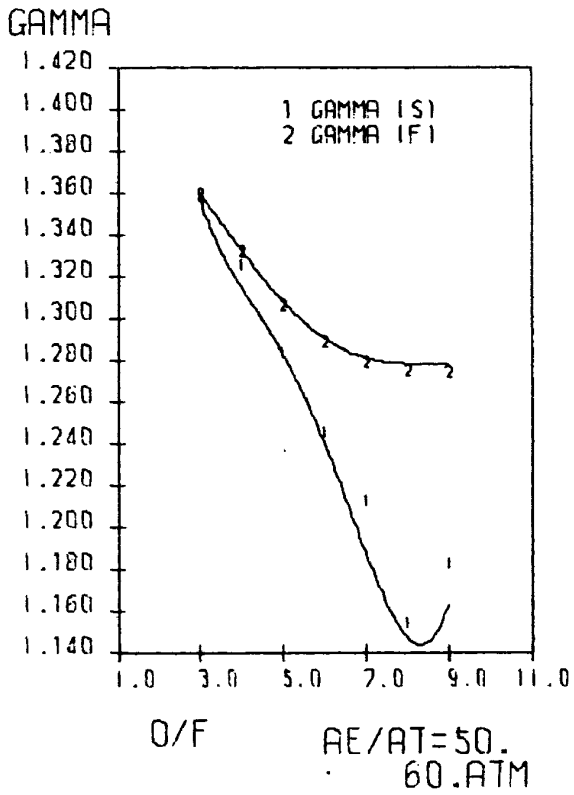


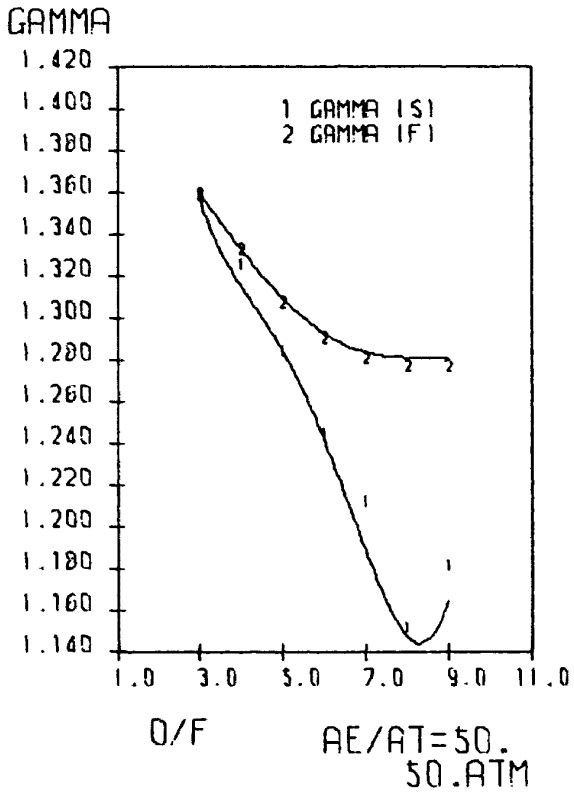
図 B 6—14

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



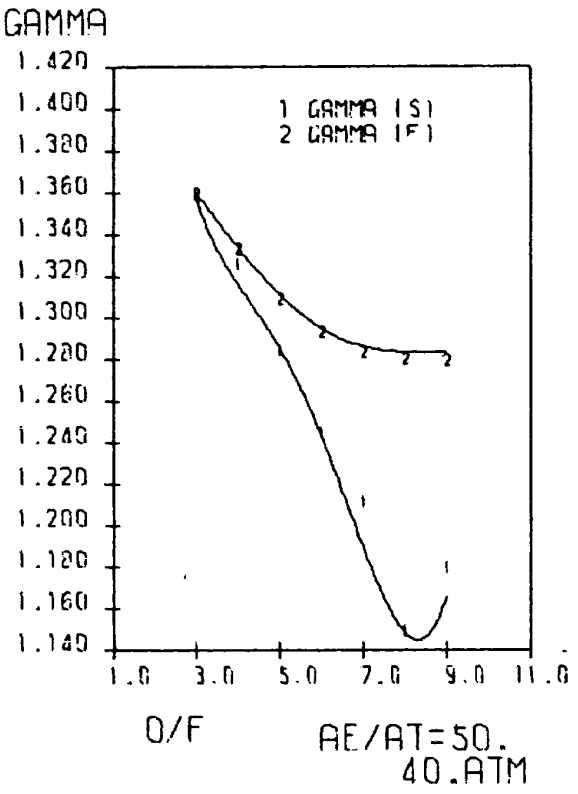


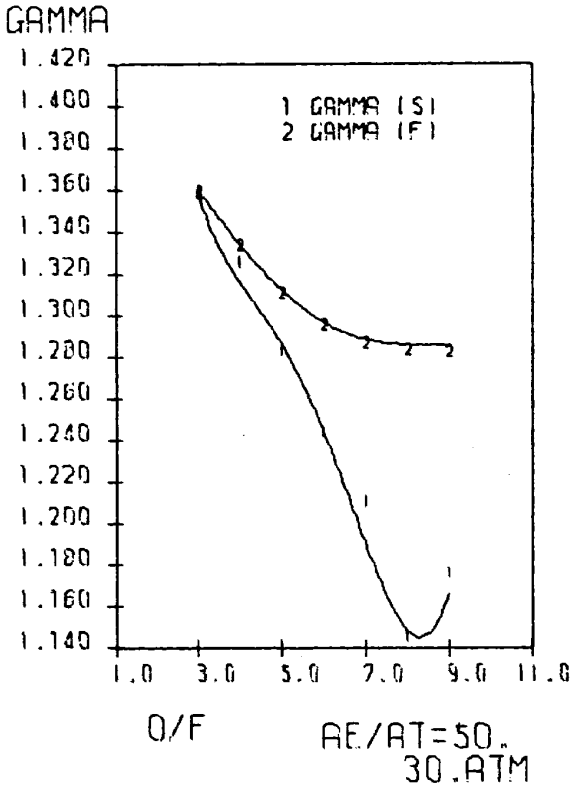


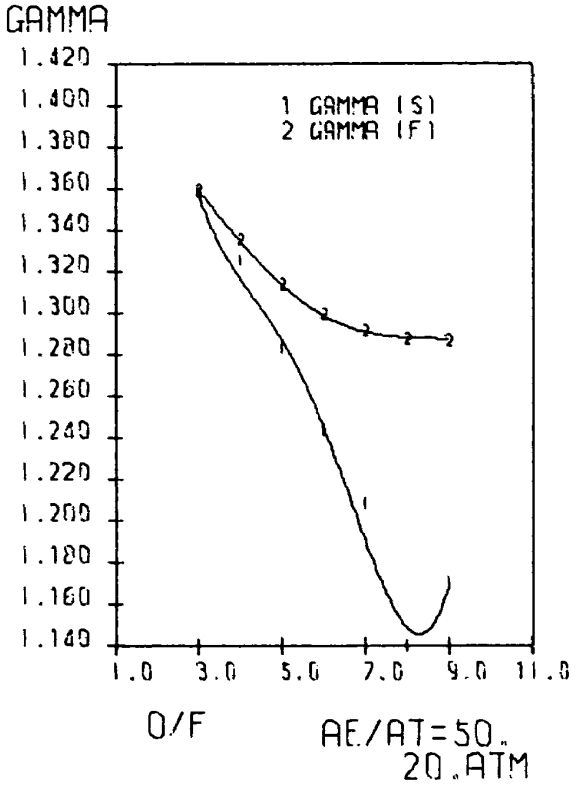


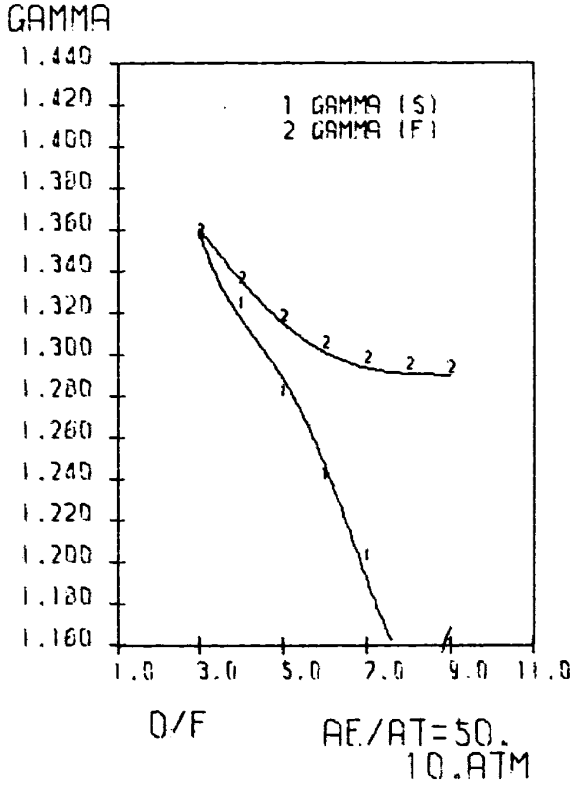
図B 7－1

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



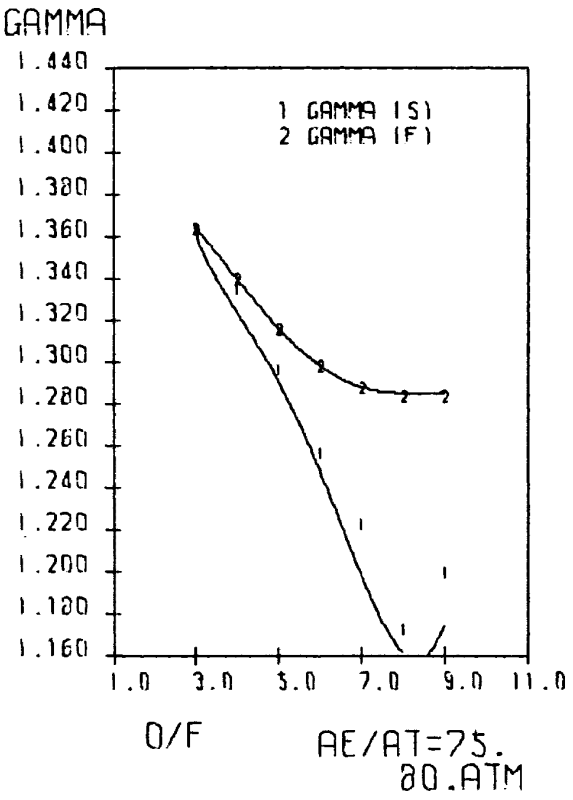


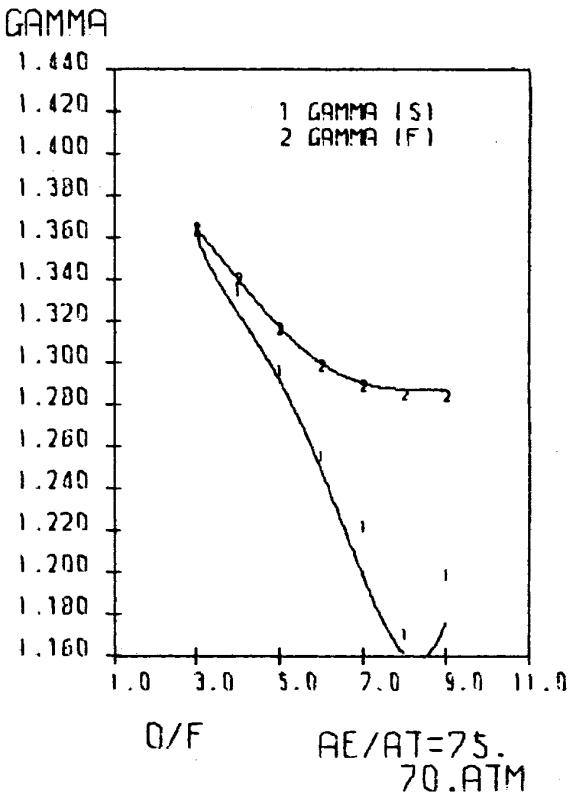


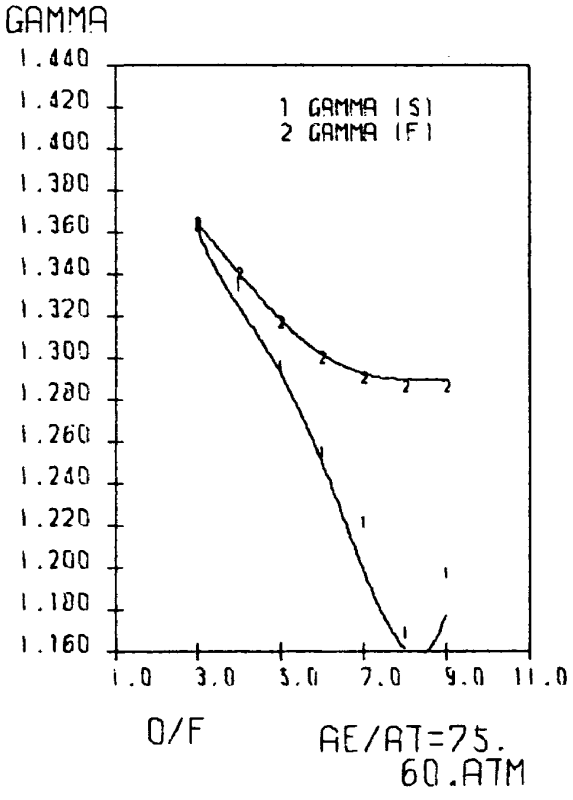


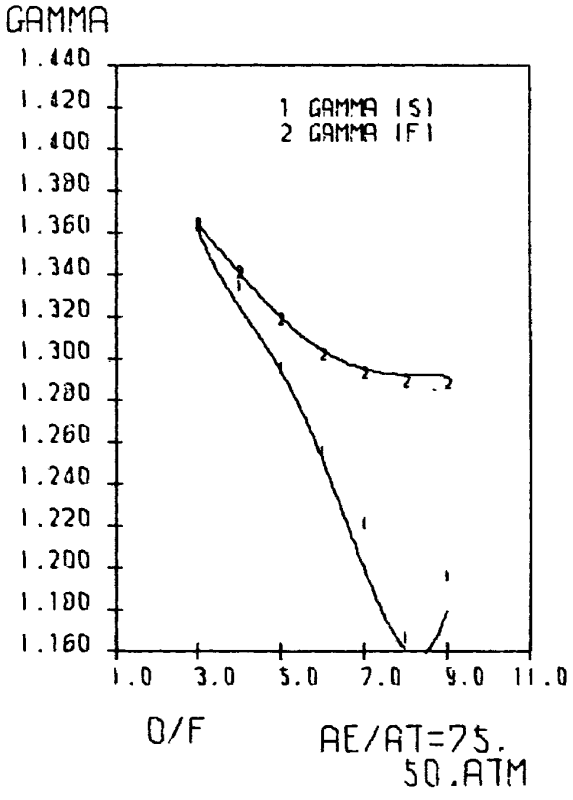
図B 7－2

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



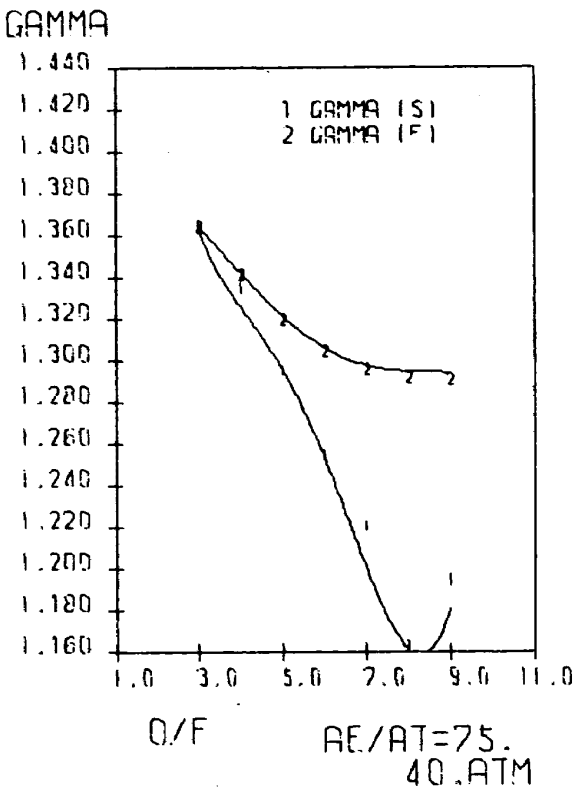


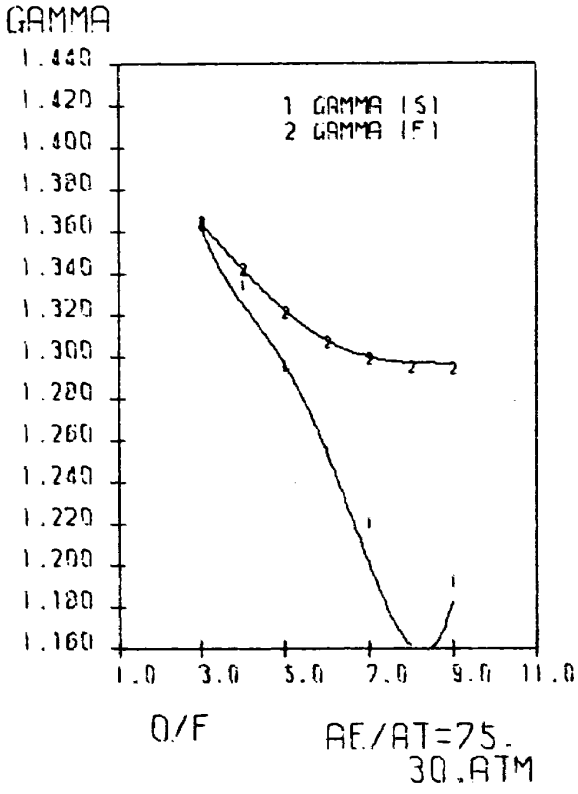


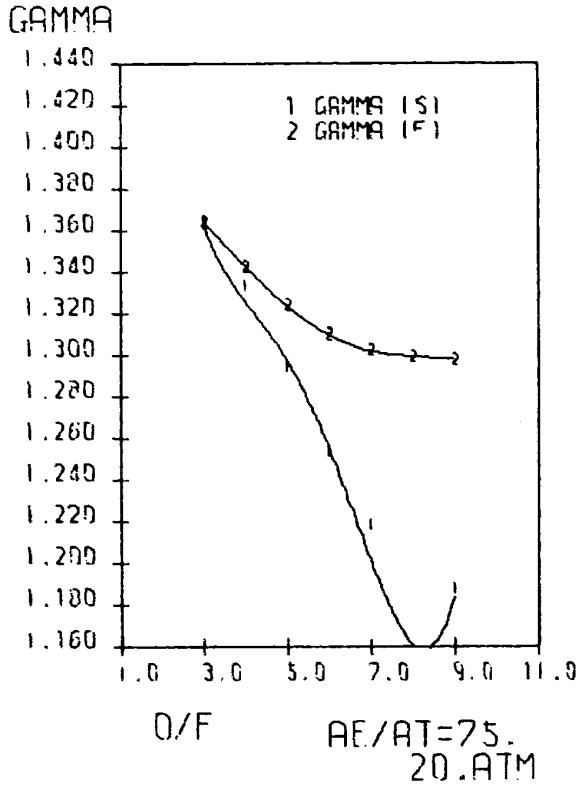


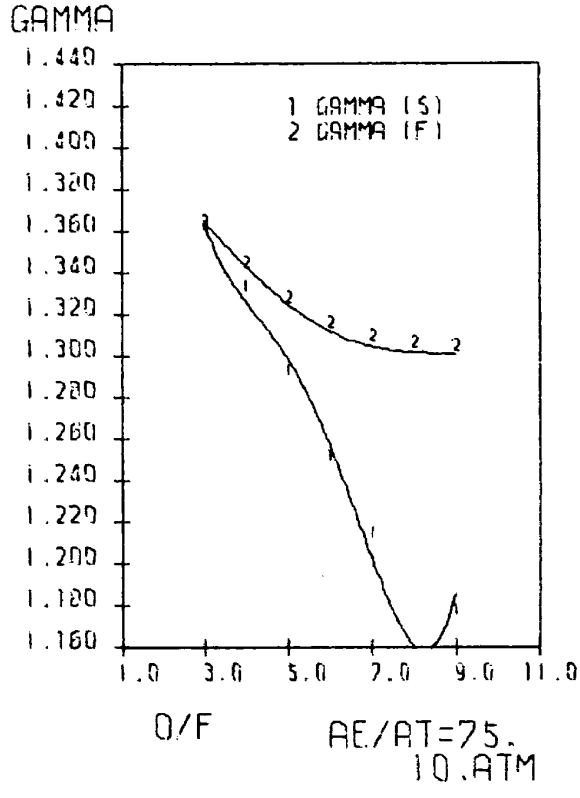
図B 7－3

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



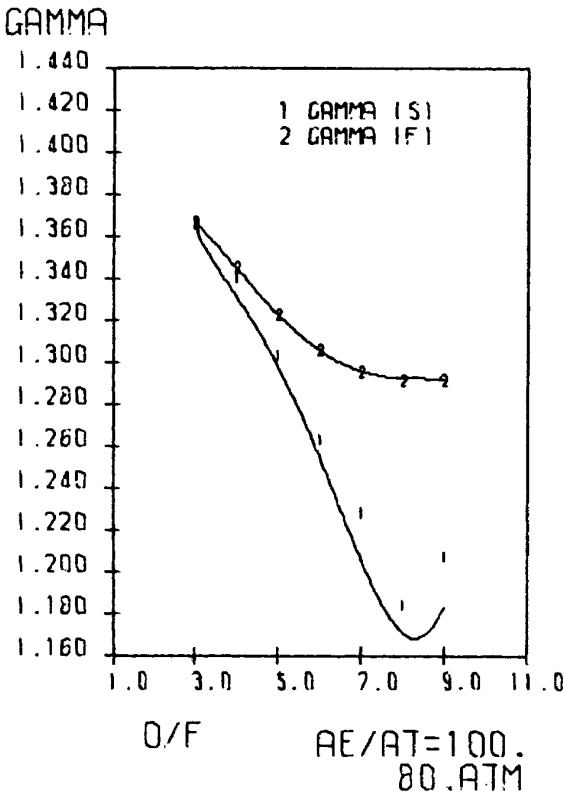


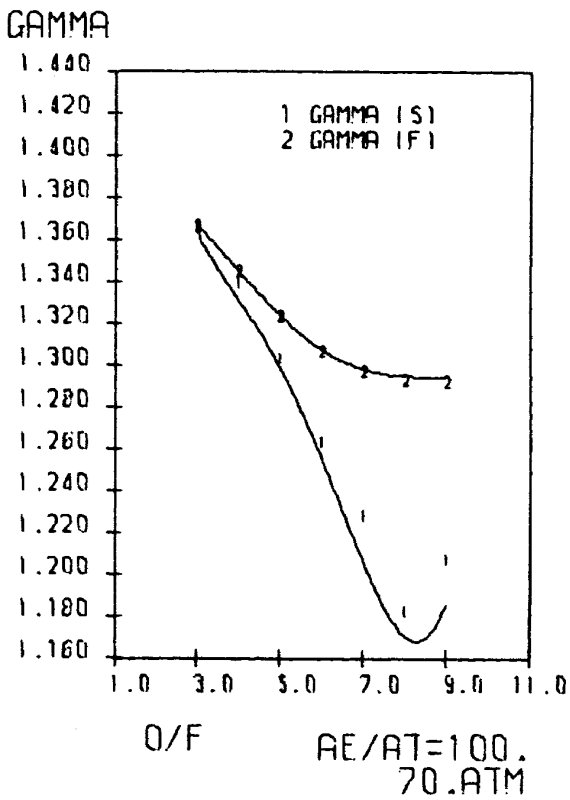


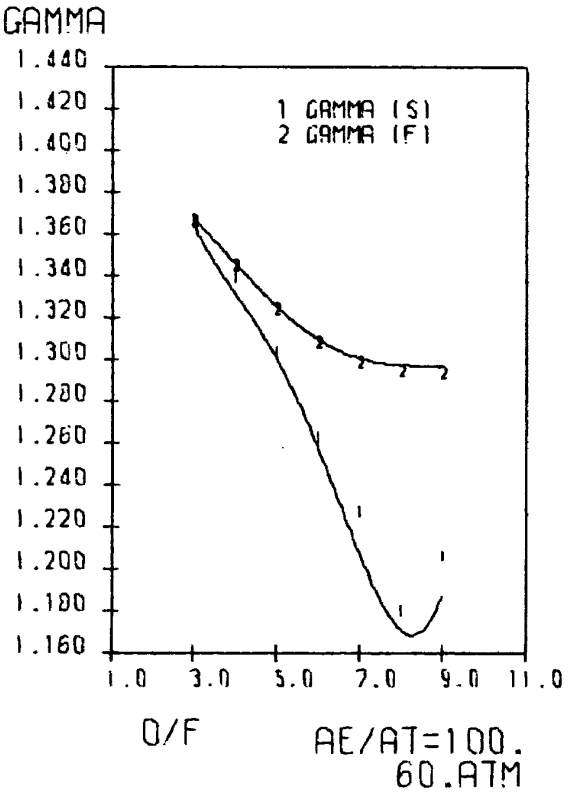


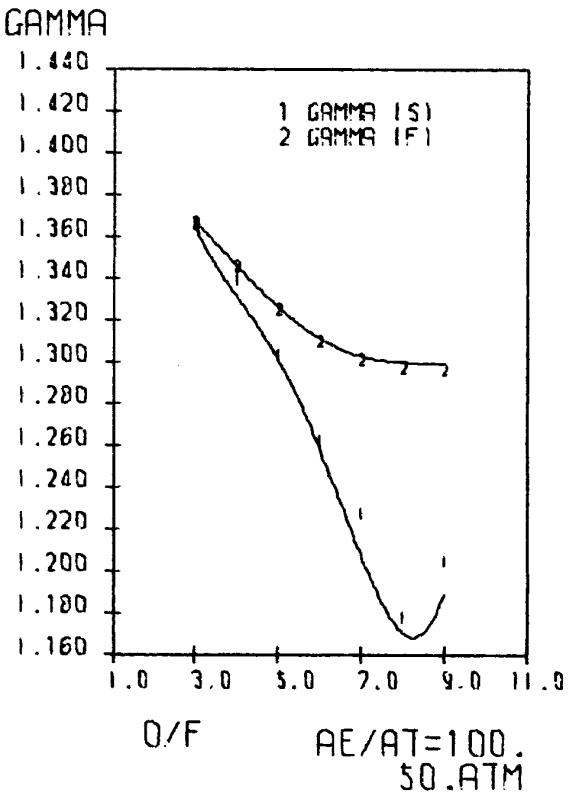
図B 7－4

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



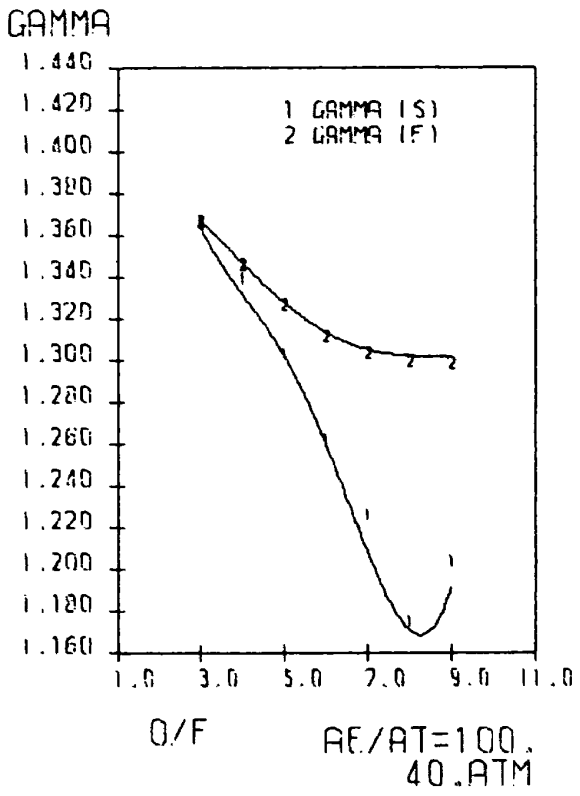


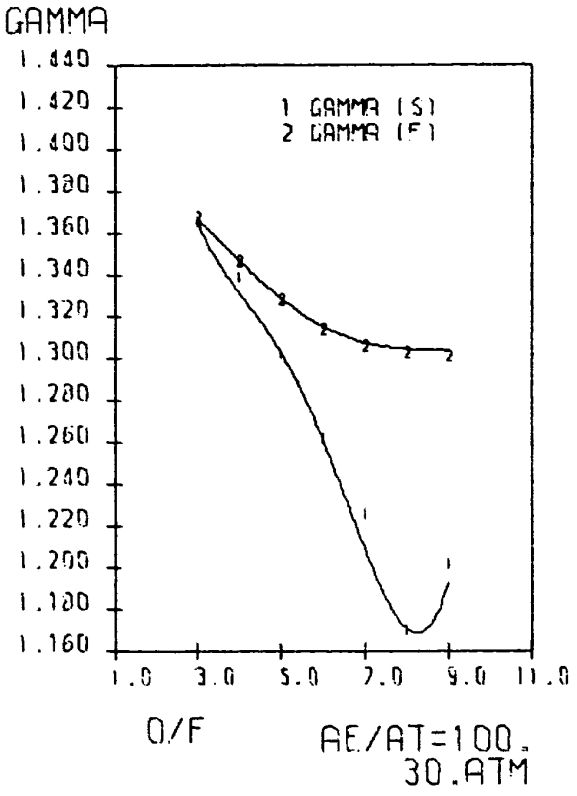


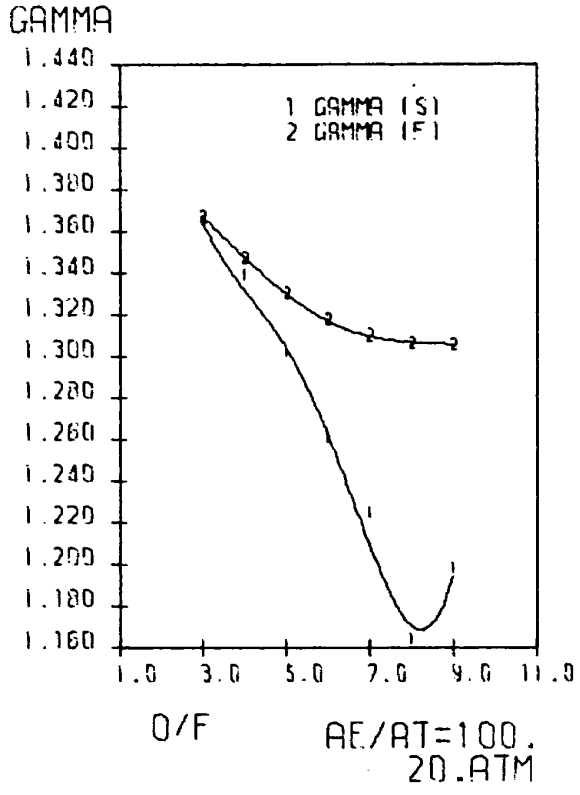


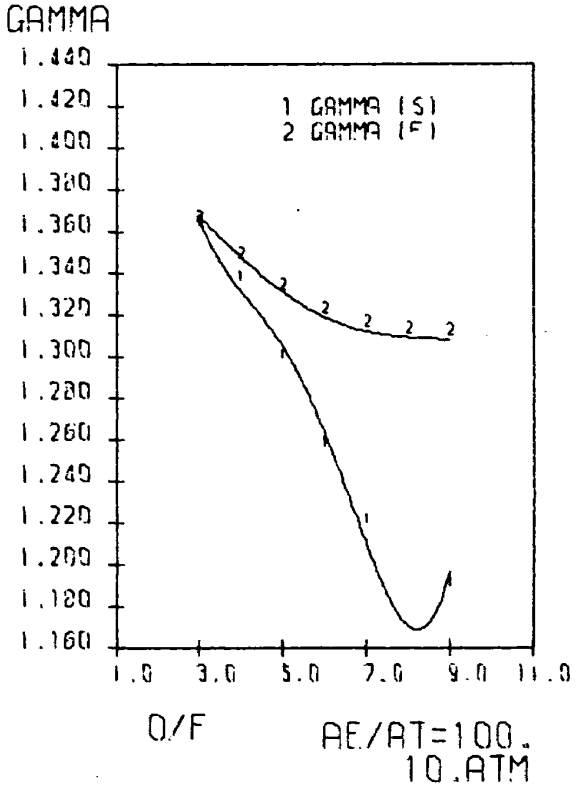
図B 7－5

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



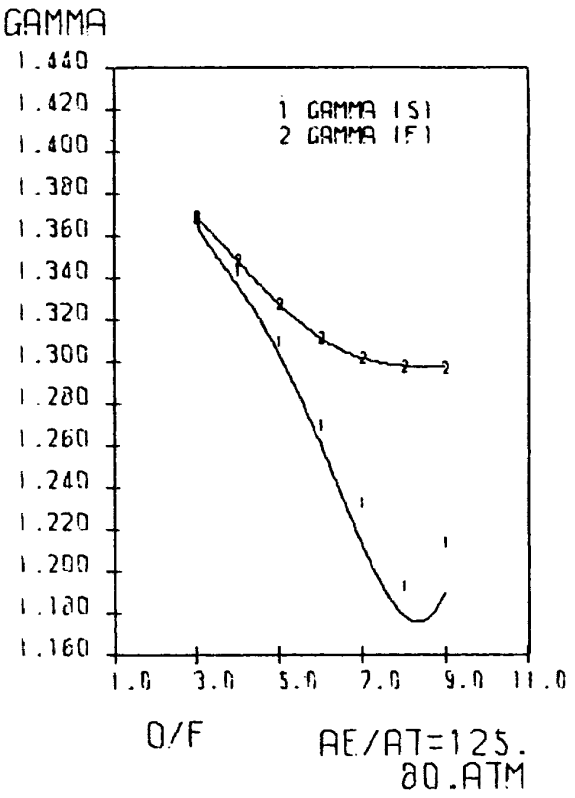


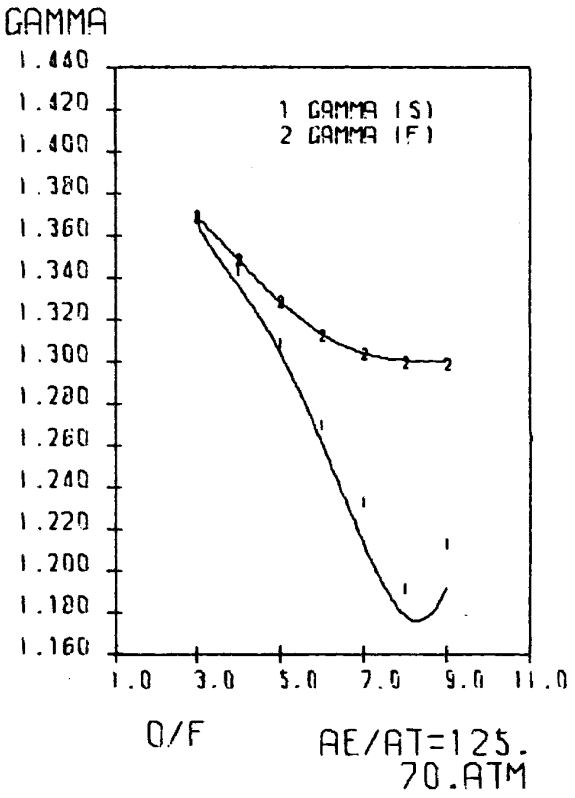


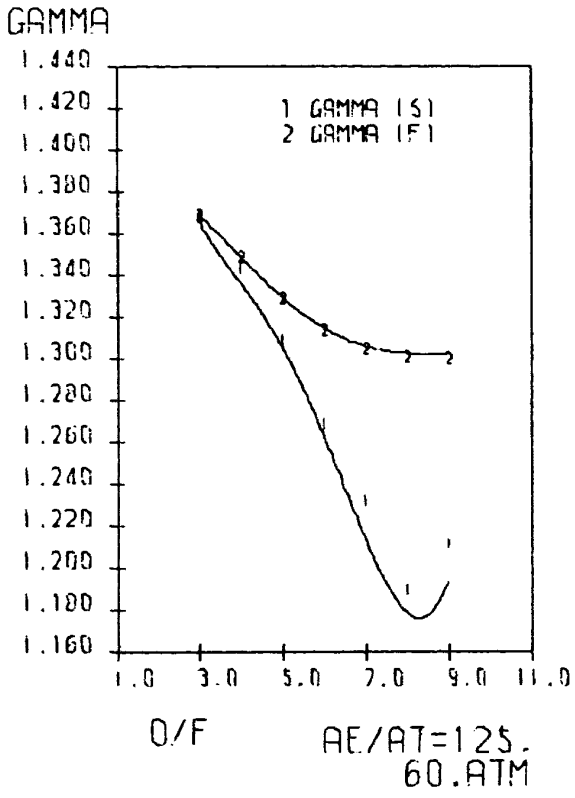


図B 7－6

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







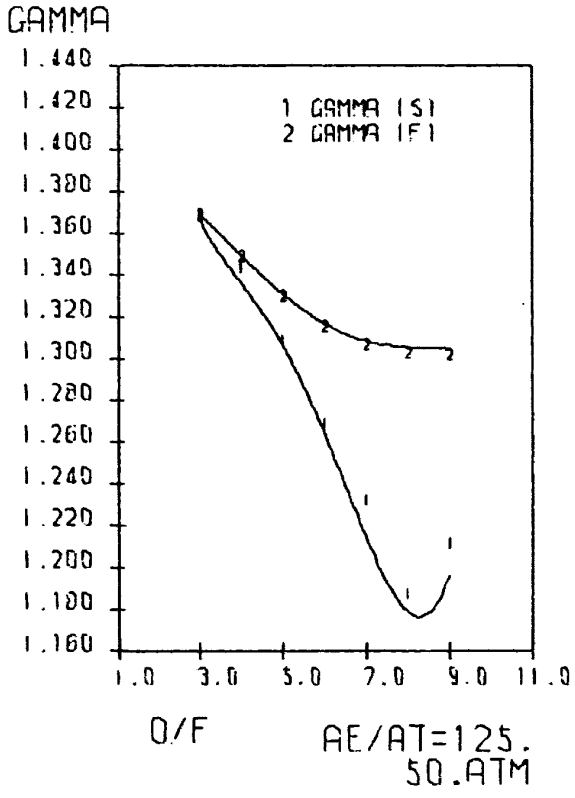
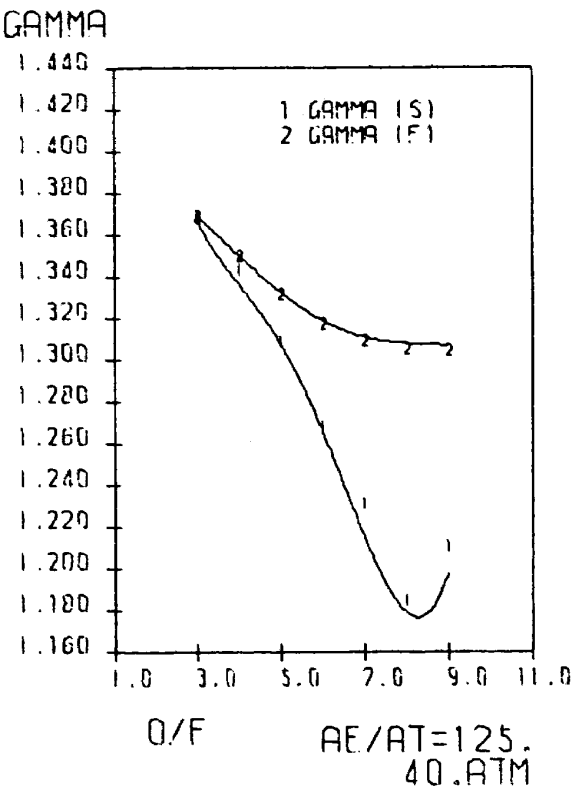
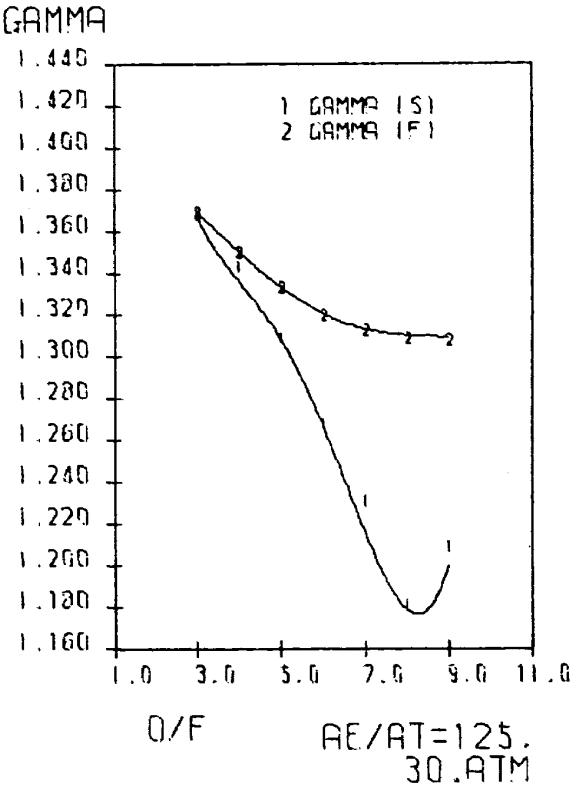
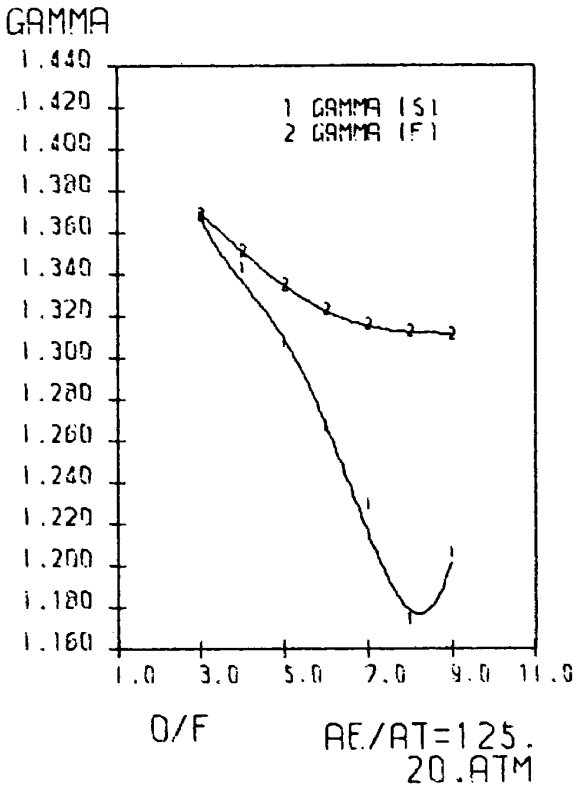


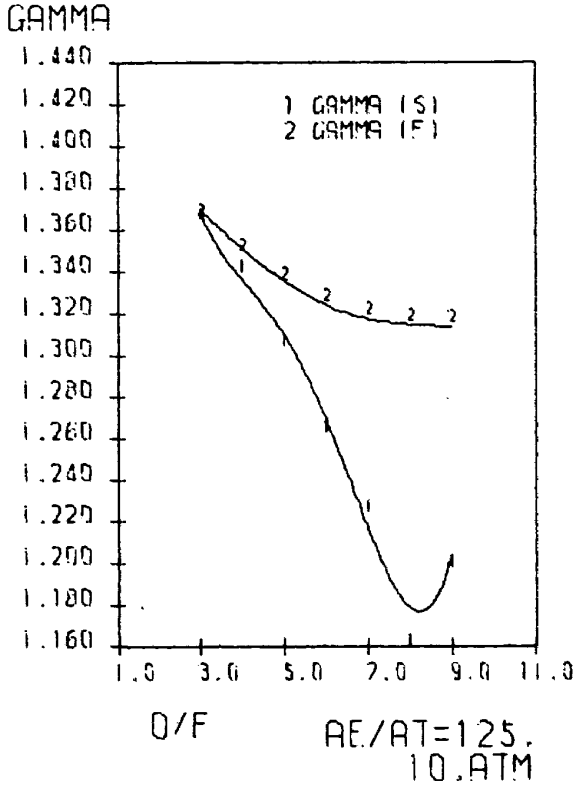
図 B 7－7

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



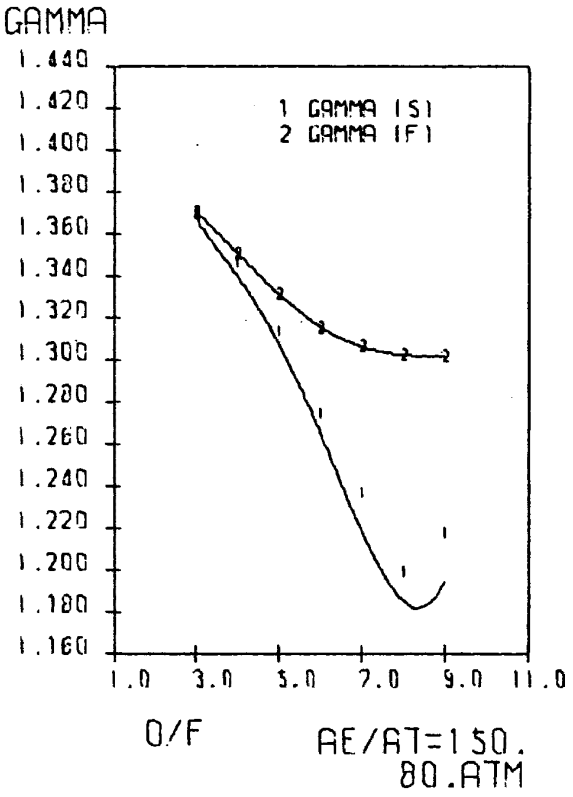


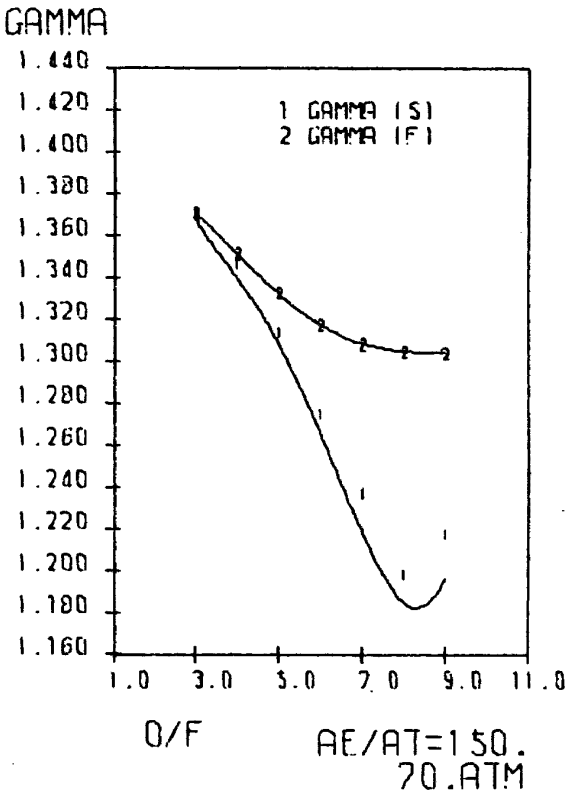


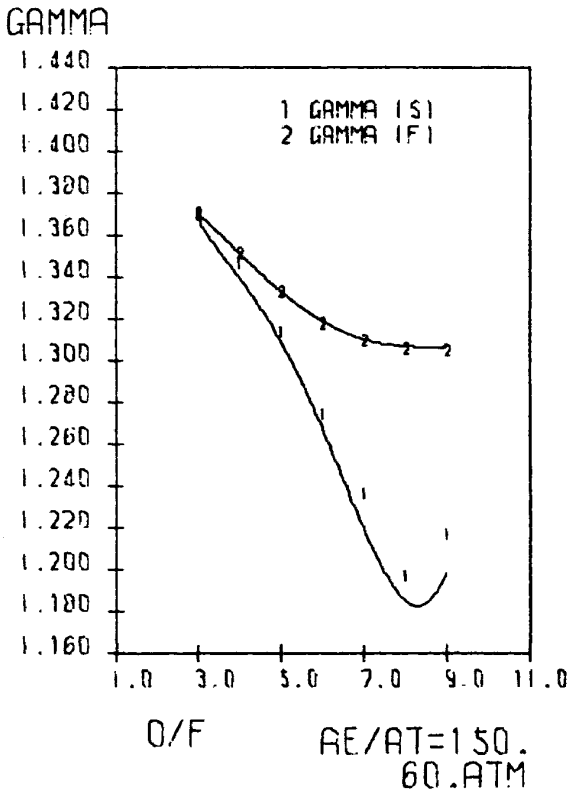


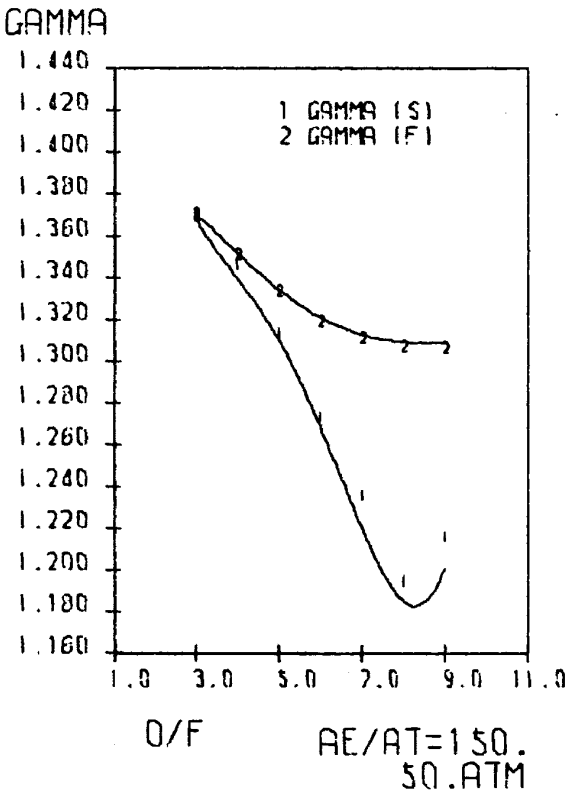
図B 7－8

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



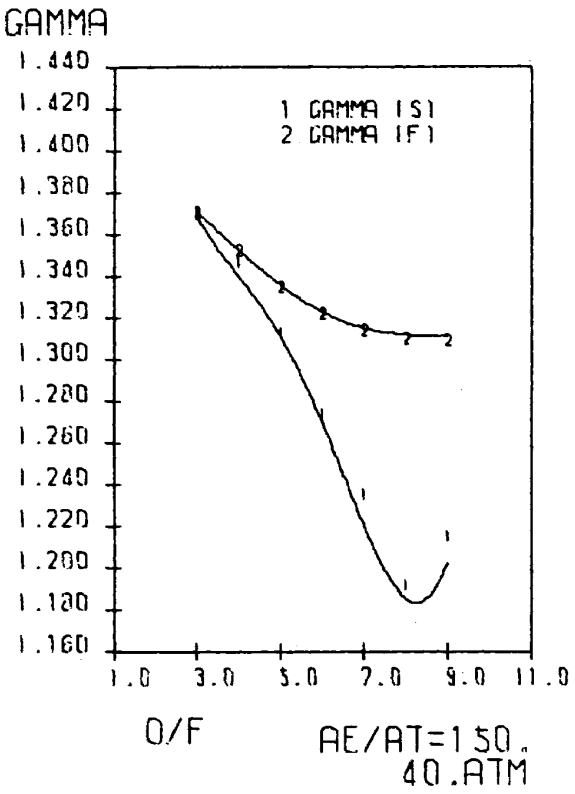


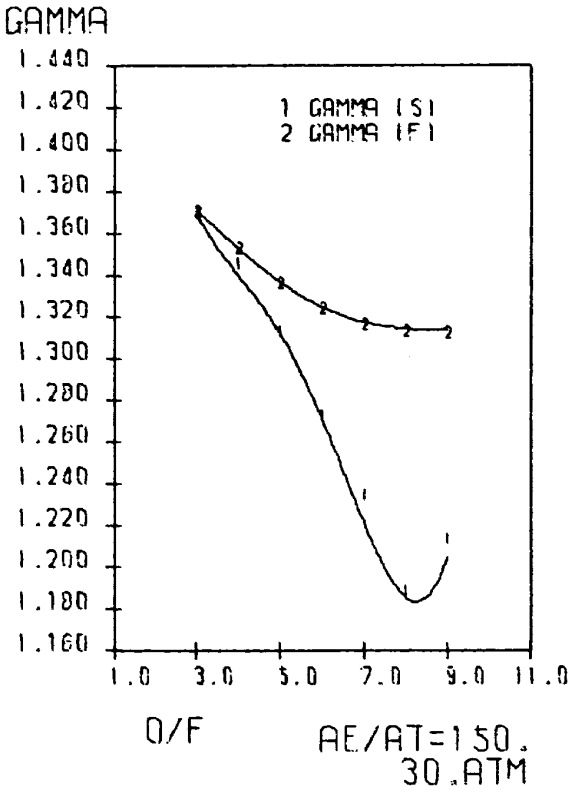


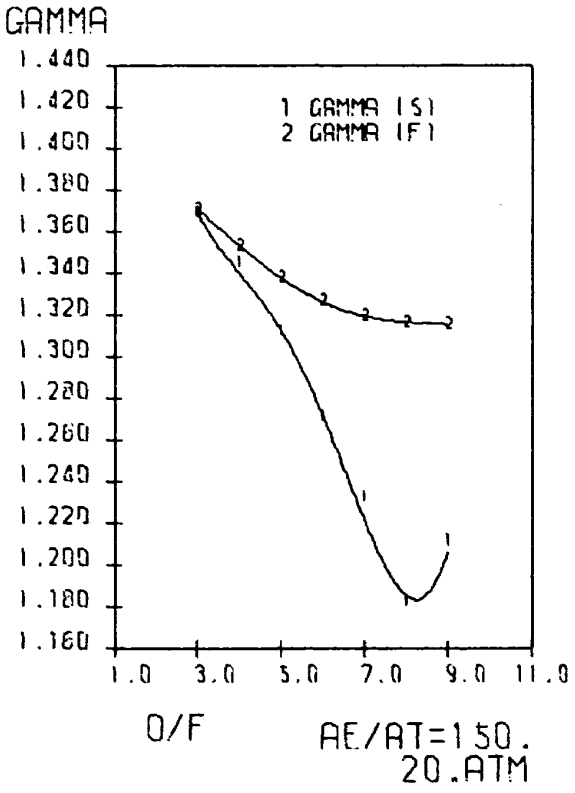


図B 7－9

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2134.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







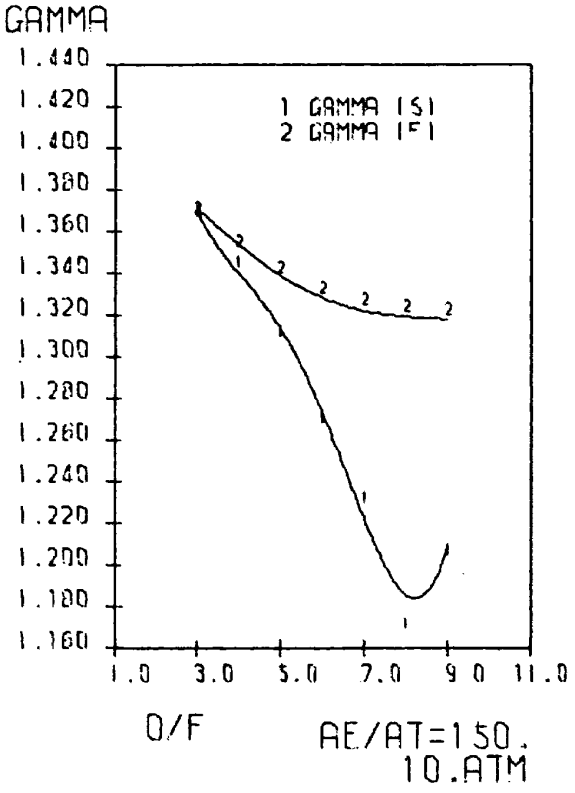
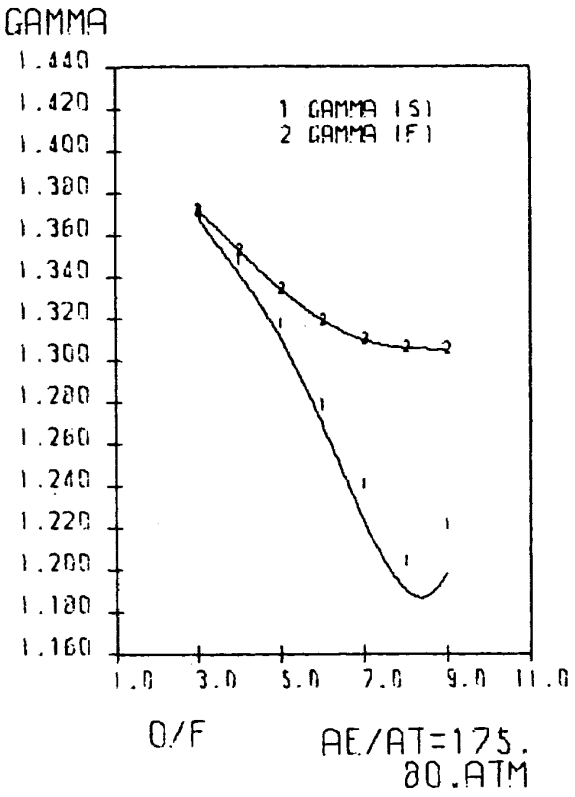
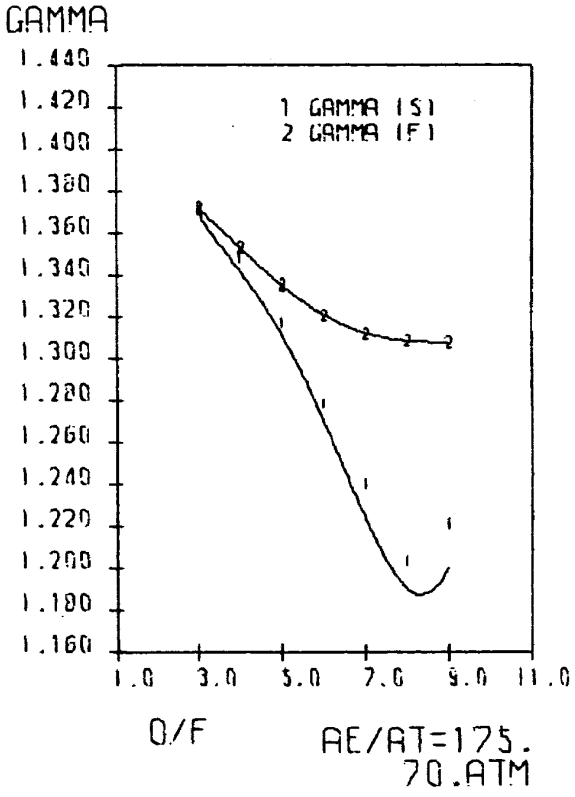
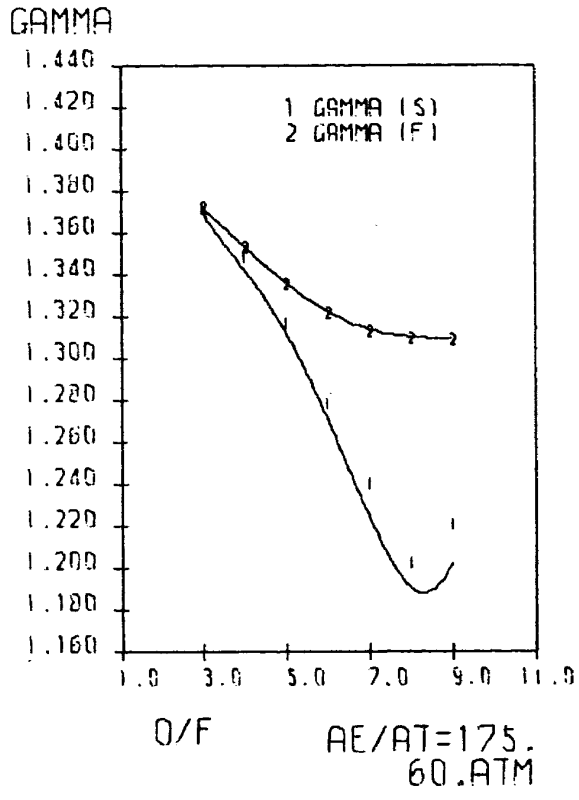


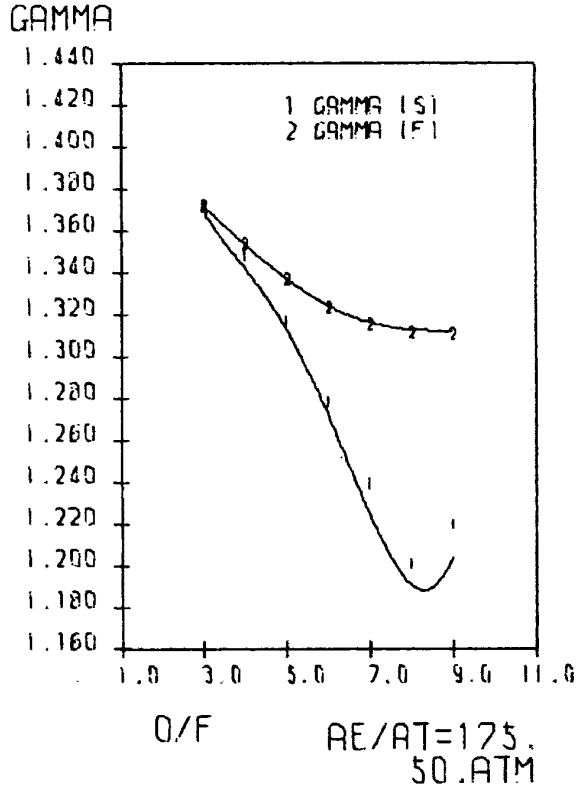
図 B 7—10

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



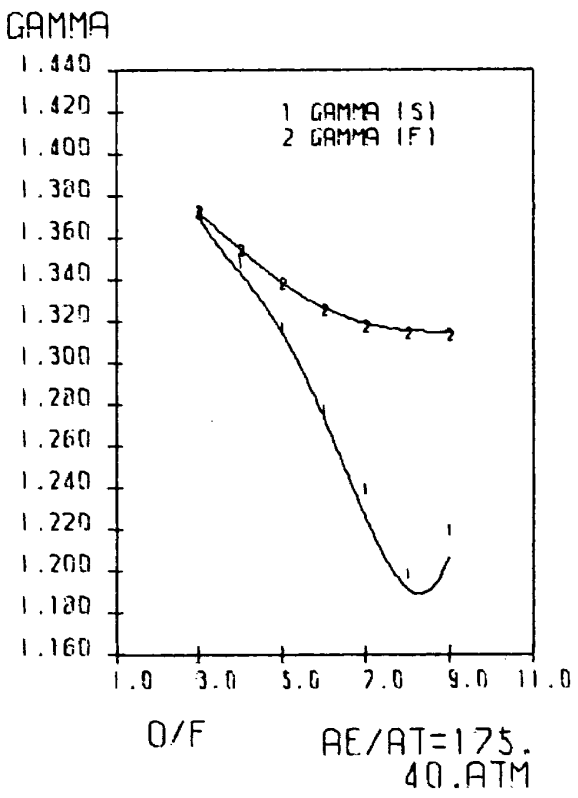


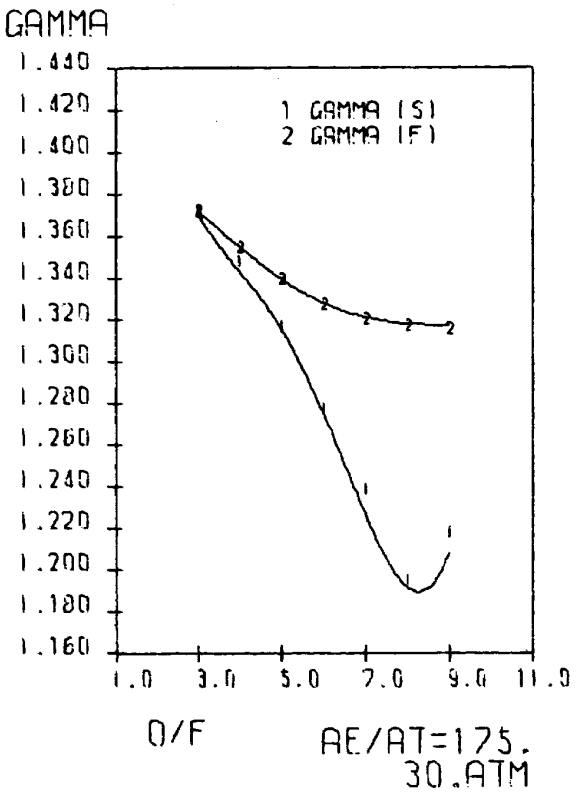


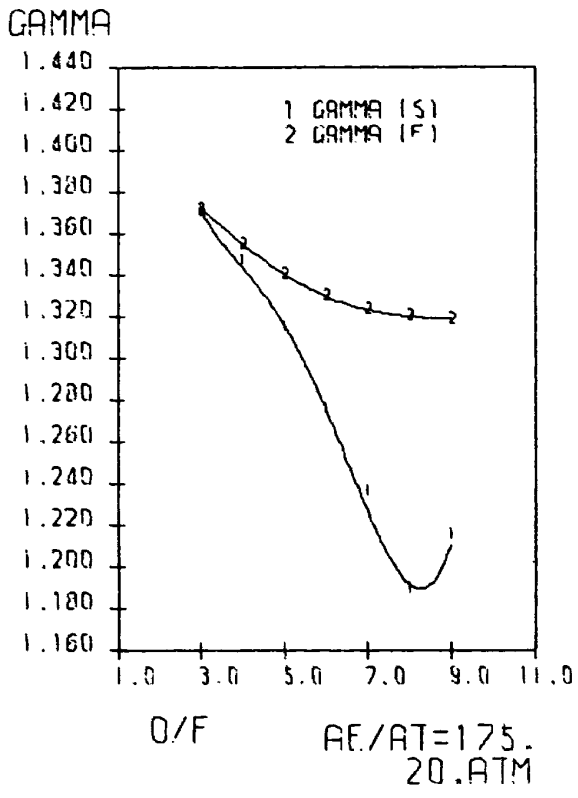


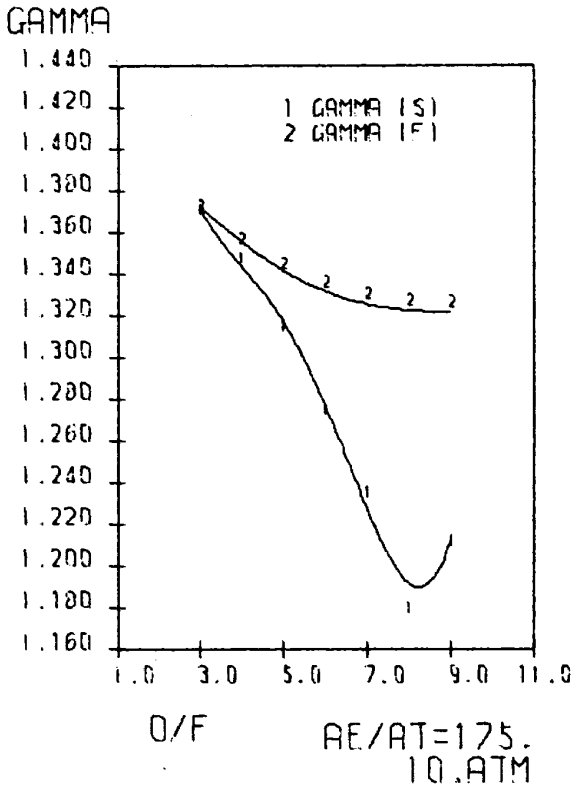
図B 7−11

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490



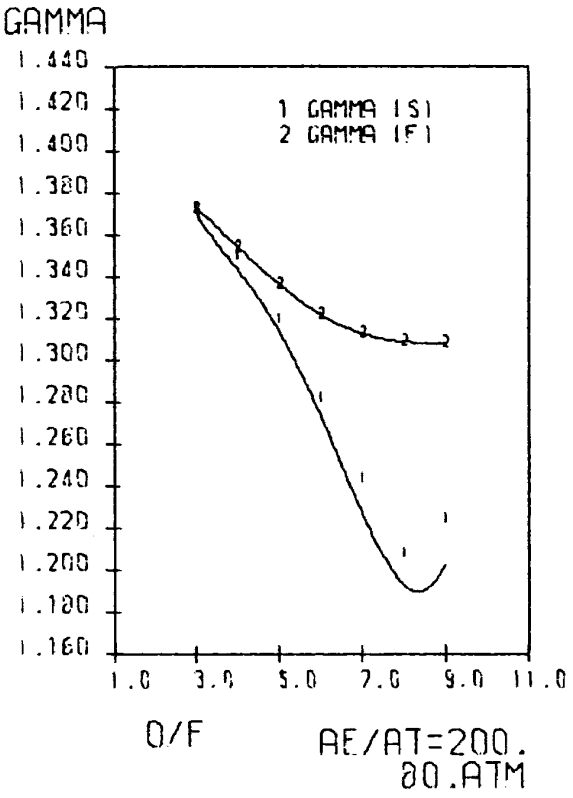


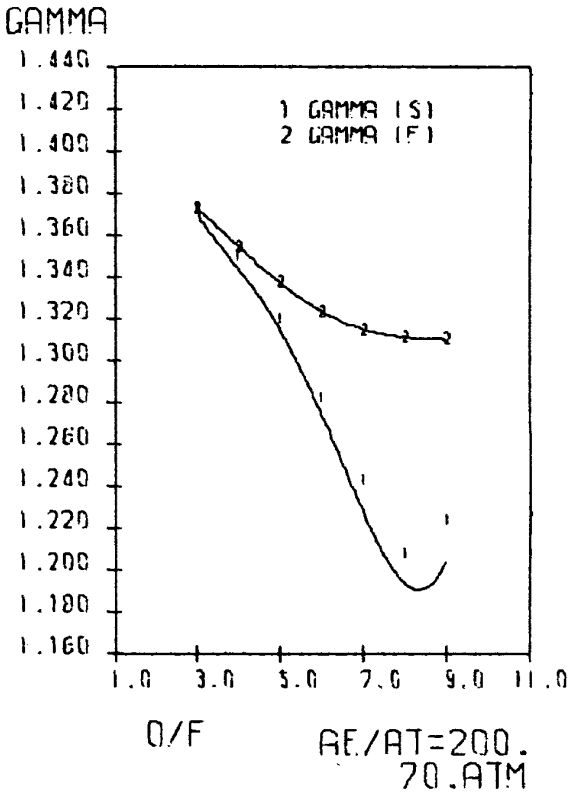


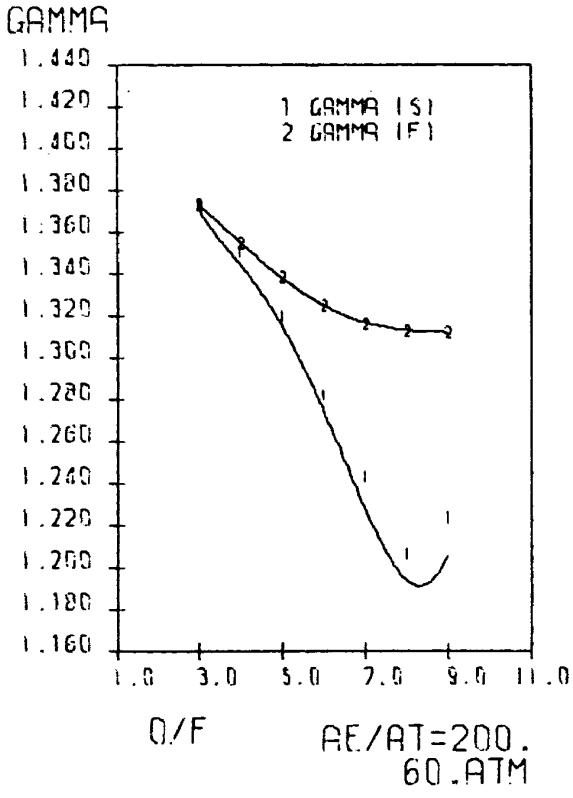


図B 7−12

CHMICAL FORMULA	WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H 2.0	100.00	-2154.00	L	20.27	F	0.0709
O 2.0	100.00	-3102.00	L	90.18	O	1.1490







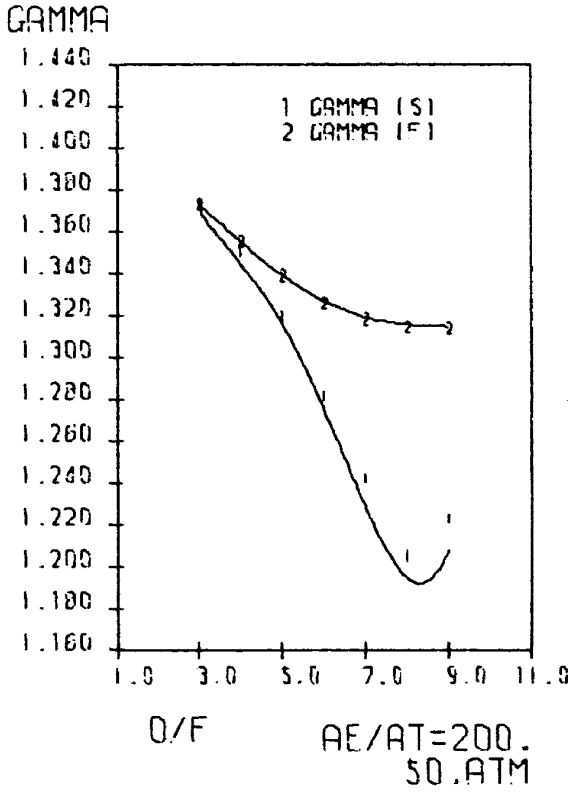
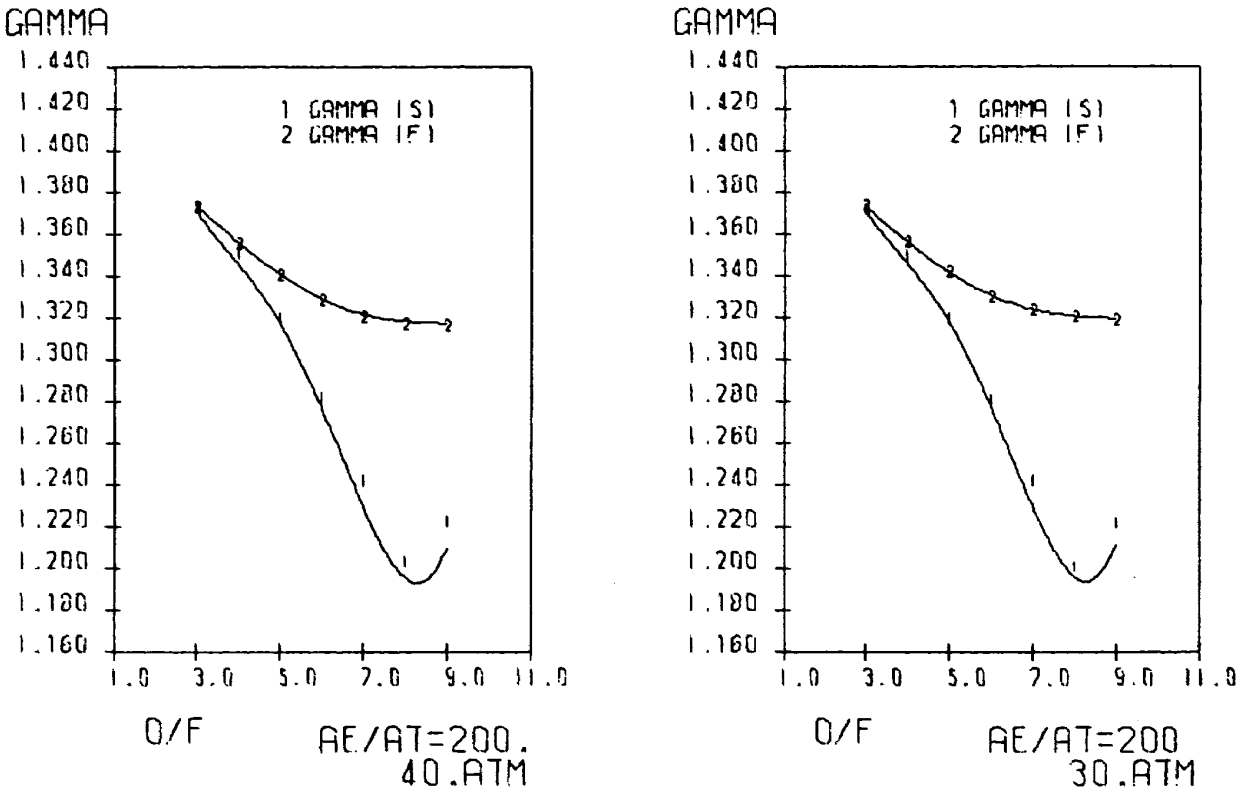
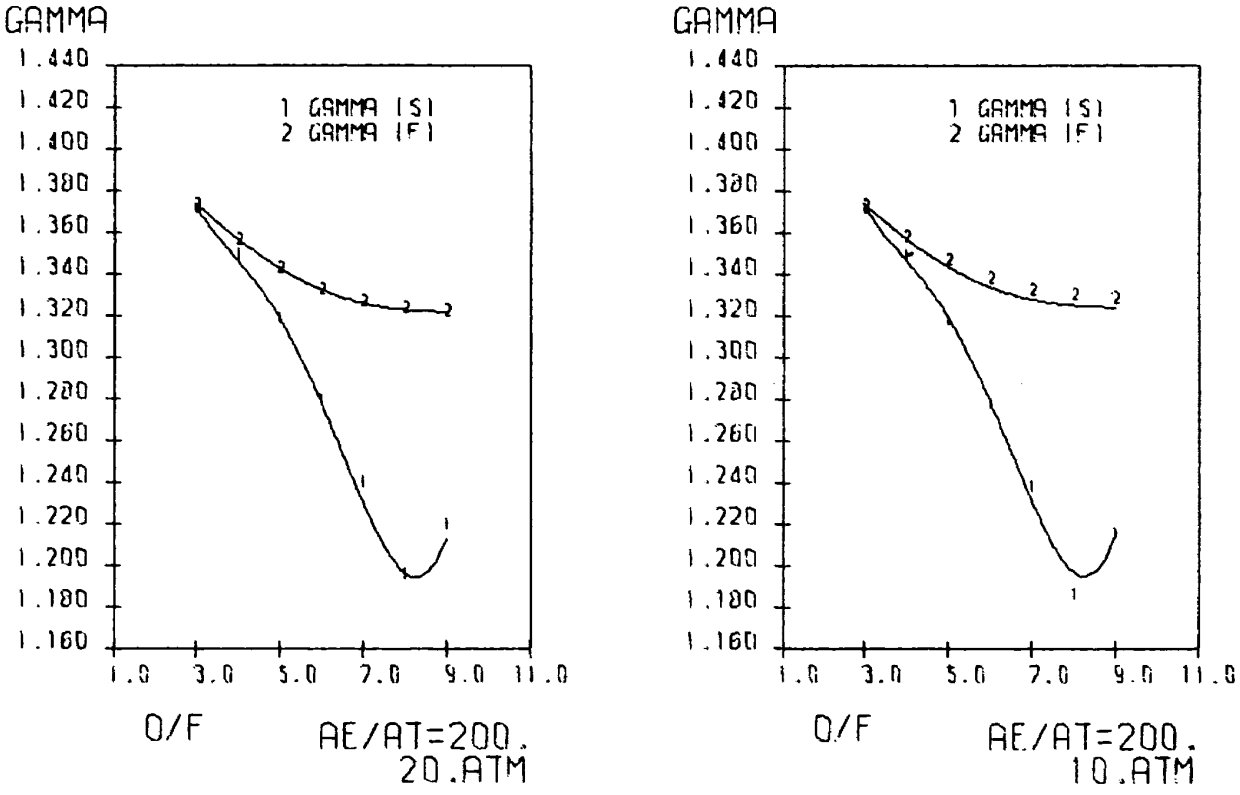


図 B 7—13

CHMICAL FORMULA		WT PERCENT	ENERGY CAL/MOL	STATE	TEMP DEG K		DENSITY G/CC
H	2.0	100.00	-2154.00	L	20.27	F	0.0709
O	2.0	100.00	-3102.00	L	90.18	O	1.1490





図B 7−14

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