P04

超高分子量ポリエチレン繊維複合材/アルミニウム合金デブリバンパーからのイジェクタの低減

Reduction in Ejecta from Ultra-high Molecular Weight Polyethylene Fiber Composites/ Aluminum Alloy Debris Bumper

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超高分子量ポリエチレン繊維の複合材は, 防御材料として有望である. この材料とアルミニウム合金を接着したデブリバンパーを用いて, イジェクタを低減しつつ, バンパーとしての性能は同等もしくは向上するようなデブリバンパーを目指して, 研究している. その結果を報告する.

A composite using ultra-high molecular weight polyethylene fiber is a promising material for defense materials. Our group proposed an aluminum alloy plate glued with the composite to reduce ejecta so as not to decrease bumper performance. We would like to report some results using ultra-high molecular weight polyethylene fiber composites.

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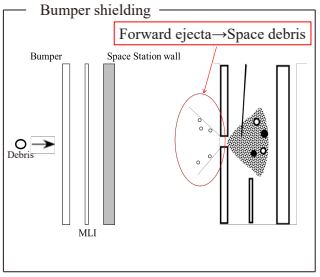
1. Reduction of Fragmentation Debris

Need to development of debris bumper that is less likely to generate fragmentation debris

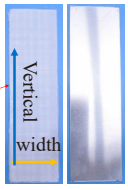


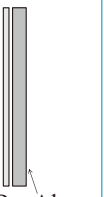
2. FRP (Fiber Reinforced Plastics)

FRP: Dyneema® Unidirectional Sheet Material:
Dyneema® HB26 (DSM) (UHMwPE fiber composites)

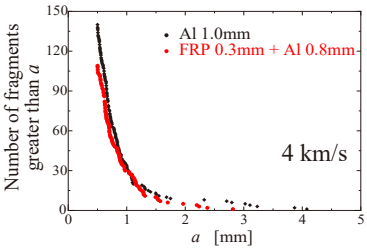
- Low density
- Impact resistance

The vertical direction of the fibers is the collision surface

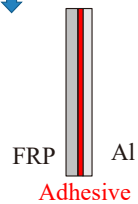




FRP Al (A6061-T6)



Fuchita, Master thesis, Nagoya Institute of Technology (2018)



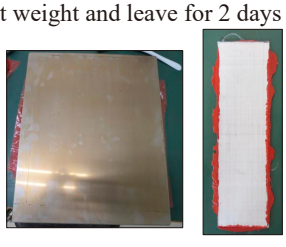
This study verifies the effect of the adhesive on the amount of forward ejecta

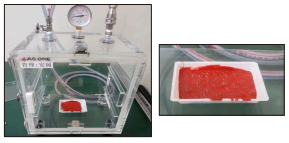
3. Experiment Methods

- Adhesive (Wacker, RTV-S 691) method

Put primer (Wacker, G790)

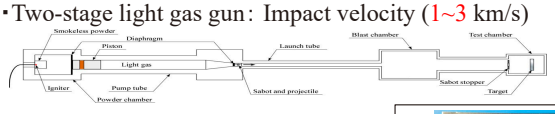
Put weight and leave for 2 days

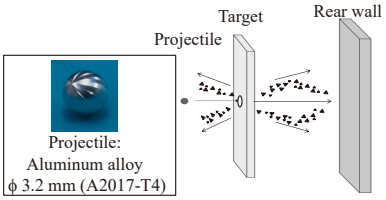


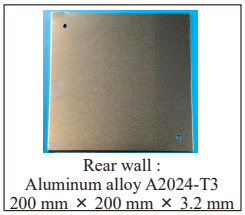


Defoaming adhesive

- Two-stage light gas gun: Impact velocity (1~3 km/s)







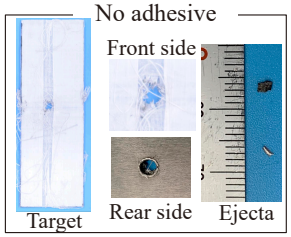
4. Targets

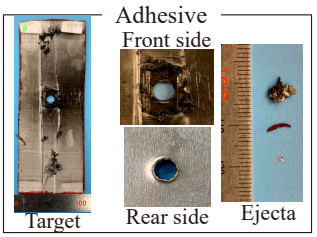
	Al 1.0 mm	FRP 0.3 mm+Al 0.8 mm (No adhesive)	FRP 0.3 mm+Al 0.8 mm (Adhesive)
Area density (g/cm²)	0.270	0.242	0.272

Fuchita, Master thesis, Nagoya Institute of Technology (2018)

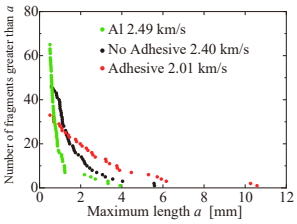
5. Experiment Results

1, Targets and ejecta after impact experiments





2, Evaluation of the number of forward ejecta



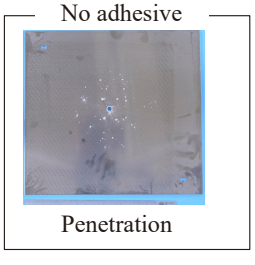
Relationship between ejecta and adhesive

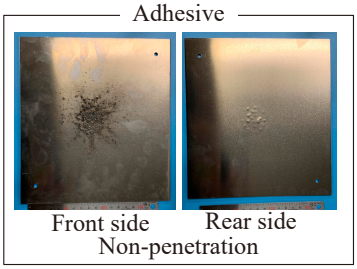
Percent of each ejecta

		No adhesive	Adhesive
Total number of forward ejecta (Length $a \geq 0.5$mm)		49	33
Percentage (%)	FRP	6.12	39.4
	Adhesive		57.1
	Al	93.9	12.1

Total number of forward ejecta: Adhesive < No adhesive < Al (Length $a \geq 0.5$mm)

3, Evaluation of rear wall





6. Summary

Ejecta

- Adhesive's ejecta was lowest
- When classified by ejecta type, aluminum, which has a high density was very low at about 12%

Rear wall

- Defensive performance was improved

This adhesive improved bumper performance