

Development of a method for recycling factory waste carbon fiber preregs and increasing the added value of the collected material  
 (回收工厂废碳纤维预浸料并提高回收材料附加价值的方法)

Limin BAO\*, Yasushi MURAKAMI, Yaonan YU

Faculty of Textile Science and Technology, Shinshu University, Japan

\* Limin BAO: [baolimin@shinshu-u.ac.jp](mailto:baolimin@shinshu-u.ac.jp)

CFRP, which is molded using materials such as carbon fiber (CF) with high strength and a high elastic modulus, and similar materials exhibit extremely high specific strength and specific modulus compared to ordinary materials, prompting their growing use in a wide range of fields, including the aerospace, automotive, shipping, and sports supply industries.

CF prepreg, a semi-cured material made by impregnating carbon fiber fabric or unidirectional sheets with resin and a curing agent, is used in the manufacture of CFRP. The material is formed by cutting it to the shape of the target part, layering on multiple, overlapping layers, and then baking in a hot press or autoclave 2). The CF prepreg molding method is widely used in manufacturing due to the technique's consistent quality, simplicity, and high production efficiency. That said, large volumes of CF prepreg cut-offs (chips) must be generated in order to maintain the high quality and performance of CFRP products. According to statistics compiled by mold manufacturers, CF prepreg cut-offs make up about 40% of all prepreg in aircraft part production and about 25% in sports product manufacturing.

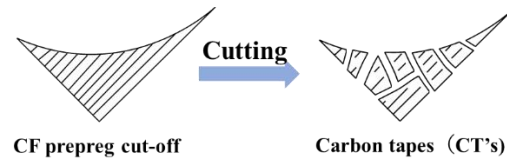
In this study, our goal was to develop a low-cost, commercially viable method for recycling carbon prepreg cut-offs in order to lower energy consumption and contribute to the realization of a recycling-oriented society. Recognizing that most of the carbon fibers and epoxy resin in CF prepreg cut-offs have not degraded, we propose a low-cost method for recycling CF prepreg cut-offs that does not damage fibers during processing and develop a system that uses this method.

**Method for recycling CF prepreg cut-offs using CT**

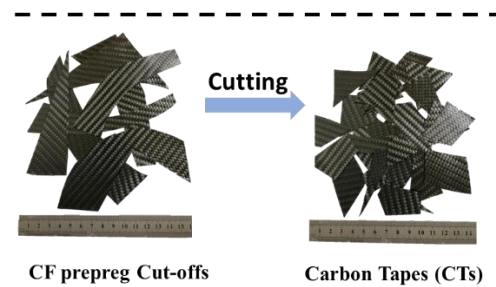
Recognizing that most of the carbon fibers themselves as well as the impregnated epoxy resin in CF prepreg cut-offs have not degraded, we developed a recycling method that yields high-performance recycled materials while maintaining the excellent mechanical characteristics of carbon fiber. Since fiber length has a significant impact on the mechanical characteristics of CFRP, we made carbon tapes (CTs) by cutting (same as factory CF prepreg cutting method) discarded CF prepreg cut-offs so as to maximize fiber length (Fig. 1).

In an effort to create a low-cost recycled material with high added value, we molded recycled CT-reinforced composite (R-CT-RC). Fig. 2 illustrates our method for recycling CF prepreg cut-offs. We prepared CTs by

cutting CF prepreg cut-offs collected from a factory. The CTs were placed in the dispersion device and dispersed to make R-CTS. We then layered multiple strips of the R-CTS (After drying) into molds (Iu: upper plate, Im: feame, Id: lower plate) and heated and pressurized them with a hot press (130°C, 0.5 MPa, 90 min.) to molded R-CT-RC.



**Cutting CF prepreg cut-offs**



**Illustration of CT preparation**

Fig. 1 Preparation of carbon tapes (CTs) from CF prepreg cut-offs

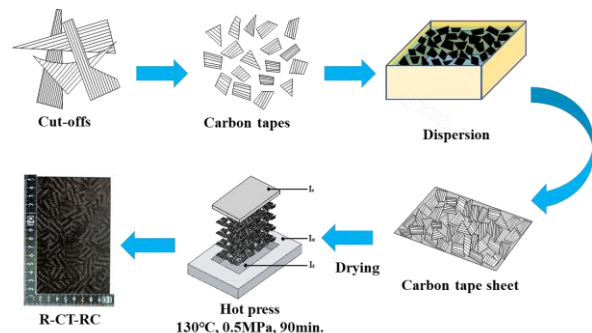


Fig. 2 Schematic diagram of recycling technique for preparing R-CT-RC from CF prepreg cut-offs

This work was supported by JSPS KAKENHI Grant Number 20H00288 and 21K19861.