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3D Printing of Carbon Fiber Composite Material: Mechanical Property and its Practical Application

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Extended Abstract

3D printing or additive manufacturing creates physical objects from a geometrical representation by successive addition of materials [1]. 3D print technology has been attracting attention not only in industry and medical care, but also in many fields such as education and art. In recent years, at a manufacturing site, 3D printing which excel in modelling complex shapes and can share modelling from anywhere if there is data, have attracted attention and are expected to reduce lead time. Among them, resin 3D printers which are expected to reduce costs and stabilize accuracy, are widely used in development areas such as prototype and mechanism confirmation. Nawadays, many kinds of materials such as metal and composite material can be created using 3D printers [2-5].

The 3D printer "Mark Two" developed by Markforged in United States is attracting attention because it can combine unique continuous carbon fibre reinforcement for the strongest, most versatile, which is difficult to process, even though it is a desktop-sized resin 3D printer. By using this Mark Two, it has become possible to realize lightweight and high-strength CFRP (Carbon Fiber Reinforced Plastic) modelling. In recent years, there have been an increasing number of cases where it is used not only for prototypes and mechanism confirmation, but also for actual products. Therefore, when the mechanical properties of composite materials such as CFRP that combines Onyx and Carbon fibre can be clarified and a practical modelling method are able to be established, it is considered that the shaped CFRP can be applied as an actual product. The purpose of this study is to evaluate the mechanical properties of CFRP created using a 3D printer, and to use the results, substitute for metal products and to apply them to resin products.

Therefore, first a CFRP test piece was created using Mark Two and the mechanical properties was evaluated from a three-point bending test. As a result, it was clarified that the strength is greatly affected by the carbon fiber orientation method and stacking direction. In addition, as an application to products, the claw and chuck handles for robot hands and were evaluated through various tests. As a results, it was clarified that it was difficult to apply it to products to which arbitrary force is applied, it can show superiority in usage methods aimed at weight reduction such as small transfer robots.

We believe making use of full advantages of 3D printers when we acquire creating know-how using 3D printers and proceed with research from a further perspective in the future.

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