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Fundamental research for design of composite materials in vacuum environments

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The weight loss of the organic composite materials and their matrix resins have been measured in vacuum. These are intended for use as insulating materials of fusion superconducting magnets or as structural materials used in aerospace application. Since in these applications they are used under the radiation environments, the degradation of mechanical strength will be measured together with the weight loss in the radiation environments.

In this experiment the before irradiation test was conducted to obtain a resin selection guideline. The resin used was basically epoxy and the resins with different numbers of functional groups and curing agents were prepared. The weight loss of these resins after curing was measured and the effect of post-curing was also investigated. Furthermore, Glass Fiber Reinforced Plastics (GFRP) and Carbon Fiber Reinforced Plastics (CFRP) were prepared using the identical resin matrices as the resin samples and the weight loss of each composite material was also measured.

Even in the epoxy with a low crosslink density, the weight loss was suppressed by the post curing. The weight loss was not also observed in FRP having a same epoxy matrix with identical heat treatment. No weight loss was observed for the polyfunctional epoxy and the FRP having the polyfunctional epoxy. Based these data, a guideline was obtained for selecting the epoxy materials used in vacuum.

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