DEVELOPMENTS OF SMART MECHANICAL MATERIAL SYSTEMS BY INNOVATIVE PROCESSING AND DESIGN

ABSTRACT

Innovative fabrication process and designing concept to realize smart and robust mechanical material systems will be mainly introduced in this seminar. The Type I material systems can be obtained by embedding fragile functional materials in a metal matrix such as aluminum as a protective environment. In this study, an innovative fabrication process, that is, Interphase Forming/Bonding Method (IF/B Method) developed by the author could enable successful fabrication of optical fiber sensor/aluminum composites and piezoelectric ceramic fiber/aluminum composites. The Type II material systems can be obtained without using those fragile functional materials. An innovative designing concept to realize them can be explained as follows: There exist a couple of competitive structural materials which normally compete with each other because of their similar and high mechanical properties, and they tend to have another property which is different from each other or opposite among them. So if they are combined together to make a composite, the similar property, normally high mechanical property, can be maintained, and the other dissimilar property conflicts with each other, which will successfully generate a functional property without using any sophisticated functional materials. As successful examples of this type, CFRP/aluminum active laminates and Ti fiber/Al multifunctional composites were successfully fabricated.

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