

강연 II

Thermomechanical Properties of Thermal-Stress Relief Type of Functionally Gradient Materials

Ryuzo Watanabe

Department of Materials, Faculty of Engineering, Tohoku University, Sendai 980, JAPAN

The present status of the thermomechanical evaluation of functionally gradient materials (FGMs) for space plane application was reviewed, in which research activities and the cooperation of the national project team organized to study FGM science were demonstrated. The project team was divided into three working groups: designing, processing and evaluation, each of which had their own tasks in the project cooperation. The testings details of the various thermomechanical tests for the FGM samples fabricated by the processing groups were described, along with their corresponding heating conditions of the real environments in the space plane application. For small-sized samples, laser beam heating test and burner heating test were well applied to study the heat shielding and heat resisting properties. Arc-heated wind tunnel test and high temperature/high velocity gas flow test were used for large-sized panel assemblies having cooling structures. The criteria for the evaluation of the heat shielding and heat resisting properties of the FGMs, as well as a crack activation mechanism in their differential temperature heating, were proposed on the basis of the observation in the burner heating test.

Keywords: functionally gradient materials / space plane / material evaluation /
material design / thermal stress relaxation / heat resistance / heat shield /
thermal shock / differential temperature heating /