C/Cコンポジットの疲労と破壊に関して

論　文　要　旨

Abstract

論文題目

Title

Studies on fatigue and fracture behavior of C/C composites

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In this dissertation, the behavior of C/C composites material was discussed when the static and cyclic loadings were applied. The basic experiment and calculations were performed to understand the static fracture, fatigue fracture and crack growth behavior of C/C composites.

The two dimensional manufactured C/C composites plate which has machine-ability was used for testing. Several configurations of specimens such as smooth, notched and holed specimens were used and made by machining processes. Tensile static, tensile fatigue and cyclic bending fatigue were carried out for loading conditions. Tensile and cyclic bending fatigue was performed under load control technique and tensile static was performed under load and stroke control technique.

In the first study, it was found that the fatigue limit was dependent on stress ratio, fiber direction and notch configuration. Also, the fatigue limit and tensile strength of the notched specimens were higher than those of the smooth specimens. So, the fracture behavior of the material was different from metals and plastics. In addition the local interlaminar debonding of fiber sheets and local shear deformations are important factors in the evaluation of static and fatigue strength.

In the second study, it was found that the critical fracture stresses on the specimen were affected by fiber orientation and notch shape. The specimen geometry has more effect on ultimate tensile strength rather than fatigue strength because the slip deformation easier to develop in the direction of separation between phenolic resin and carbon fiber. The fracture behavior of fatigue and tensile specimens were related to the damage of the phenolic resin which was caused by shear deformation and succeeding breaking of carbon fiber.

In the third study, it was found that the shorter slit has longest fatigue life compared with longer slit length, holed and blunt notched specimens. The fatigue life was not related to stress concentration factor, but considered to be related with maximum stress and stress distribution. Also, the crack growth rate is affected by specimen geometry and stress intensity.

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