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## **Existing State of Absorbed Water and its Effects on the Viscoelastic Behaviour of Polyamide 6 – carbon Fibre Model Composites**

*M. Kawagoe (a), A. Ishisaka (a,b), M. Nabata (a,c), Y. Miyazaki (a,c) and K. Sanada (a)*

*(a) Department of Mechanical Systems Engineering, Toyama Prefectural University, Kosugi, Toyama 939-0398, Japan*

*(b) Present address: Toshiba Nanoanalysis Co., Ltd., Saiwai-ku, Kawasaki 210-0901, Japan*

*(c) Present address: YKK Corporation, Kurobe, Toyama 938-8601, Japan*

The effects of absorbed water on the dynamic viscoelastic behaviour of polyamide 6 – carbon fibre (PA6-CF) model composites were investigated with reference to the structure and mobility of water, which were evaluated by FT-infrared microspectroscopy (micro-FTIR) and differential scanning calorimetry (DSC), respectively. The water contents in PA6-CF specimens were prepared by being stored in air with various humidities, which were adjusted by a saturated salt solutions method at constant temperatures, except the DSC specimens soaked in distilled hot water. The water absorption behaviour showed the Fickian type of diffusion at all the humidities. The micro-FTIR revealed the water in the polymer-fibre interfacial region to exist in clusters near liquid state. The DSC measurements clearly indicated the exothermic peaks due to freezable bound water and/or free water, which were never observed in neat PA specimens. These FTIR and DSC measurements suppose the interfacial region to be in heterogeneous (rather empty) microstructure, in which both the molecular chains and the water molecules may more easily move cooperatively. This may correspond to a feature of higher energy dispersion of the interfacial region, which was observed by comparing the loss tangent,  $\tan\delta$ , of composite with that of neat polymer. The dynamic viscoelastic factors, in general, were indicated to shift to lower temperature side with increasing the equilibrium content of water. In addition, it was demonstrated that a time-water content equivalence on the storage modulus,  $E'$ , clearly holds, and that a corresponding shift factor is described by a WLF type of equation, in the form of which the temperature is replaced with the equilibrium water content.