COMPRESSION KINK BAND ANALYSIS OF HIGH PERFORMANCE FIBERS

Wansoo Huh
생산기술연구원

Compressive strength of advanced composites is a key property for many aerospace structural applications. The compressive strength of composites in most cases is limited by the fibers. Intermediate modulus (35-45 MPSI) PAN-based carbon fibers have good compressive strength (>400 KPSI). Higher modulus PAN-based carbon fibers, all pitch-based carbon fibers, and all polymeric fibers have lower compressive strengths. High performance polymeric fibers, such as poly(p-phenylene terephthalamide) [PPTA] Kevlar™, poly(p-phenylene benzobisthiazole) [PBZT] or poly(p-phenylene benzobisoxazole) [PBO] have excellent tensile and thermal properties. The usefulness of organic fibers in composites is limited by this relatively poor axial compressive strength.

In order to understand the compressive failure mechanism of high performance fibers, the compressive strengths of pitch and PAN-based carbon fibers, such as P75S, T-50, T-300, and GY-70, and polymeric PBZT and PBO single fibers were measured using a micro-scale compression apparatus in an optical microscope. With increasing compressive strain, kink band formation was observed and the number of kink bands per unit length was counted. By extrapolating to zero kink band density, the critical compressive strain was obtained. The compression failure behavior of PBZT and PBO fibers with different thermal histories and varying draw ratios was studied. The results of these experiments will be reported.