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Higher performance carbon fiber reinforced thermoplastic composites from thermoplastic prepreg technique: heat and moisture effect

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Abstract

In this study, higher performance unidirectional carbon fiber reinforced polyamide-6 composites were manufactured from prepreg by using hot compression methods with assistance of spread tow technology. UD CF/PA6 laminates with uniform fiber distribution and in good impregnation are achieved. Various mechanical properties of UD CF/PA6 laminates were evaluated by using tensile tests and three-point tests. The effects of heat and moisture on the flexural properties of UD CF/PA6 laminates were carried out through hot air exposure and hot water immersion process at different temperature for different time, respectively. The corresponding effects on the neat resin were also investigated to verify the role of matrix degradation by three-point bending tests and fourier transform infrared spectroscopy analysis. The optical microscopy and scanning electron microscopy observation were carried out to investigate the fracture behaviors and explain the fracture mechanism. Results indicated that no obvious negative effect of heat (<98°C) on the flexural properties of UD CF/PA6 laminates in one month. But serious negative effect of mixture action of heat and moisture on laminates has been verified owing to their matrix and interfacial bonding capability degradation after hot water immersion, which also led to the change of failure behavior.

Keywords: Polymer-matrix composites (PMCs); Prepreg; Heat; Moisture.

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