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Modification of tensile, wear and interfacial properties of Kevlar fibers under cryogenic treatment

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Abstract

The weak wear and interfacial properties of the aramid fiber were the main obstacles to limit its practical applications. In this study, a simple and environmental friendly method, cryogenic treatment was adopted to treat the Kevlar fiber by different cooling rates. After cryogenic conditions, the tensile, wear and interfacial shear strength (IFSS) properties of Kevlar fiber were all enhanced to some extent. The tensile strength of the aramid fiber conditioned in sharp cooling rate (QM process) increased by 24.9%, while that of the fiber conditioned in low cooling rate (TPCM process) increased a little. Moreover, the wear time of the fiber increased 51.6% and 51.1% under QM and TPCM treatments. The scanning electron microscope (SEM) and atomic force microscope (AFM) results showed that the surface roughness of the aramid fibers increased 32% and 73% after conditioned in QM and TPCM processes, respectively. Consequently, the IFSS of the fiber/epoxy resin increased 5.7% and 19% once treated by QM and TPCM processes. In this study, the cryogenic treatment was demonstrated as an effective method to enhance tensile, wear resistance and interfacial properties of Kevlar fiber for practical applications.

Keywords: Aramid fibre; Fibre/matrix bond; Wear; Mechanical testing; Cryogenic