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Growth of aligned ZnO nanorods on carbon fabric and its composite for superior mechanical and tribological performance

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Abstract

A novel idea was implemented to grow aligned ZnO nanorods on carbon fabric by directly chemical bonding to form a multi-scale reinforcing resin composite. The aligned ZnO nanorods/carbon fabric were characterized by X-ray diffraction, Fourier transform infrared spectroscopy, Raman spectra and X-ray photoelectron spectroscopy, indicating an existence of chemical bonding (C-O-Zn) between ZnO nanorods and carbon fiber. The tensile and inter-laminar shear strength (ILSS) of ZnO nanorods/carbon fabric/resin composite (C1) were 182.4 and 147.1MPa, which increased by 27% and 134% compared with bare carbon fabric/resin composite (C0), respectively. And the sample C1 possessed lower compressibility and higher recovery. As a result, the sample C1 obtained the high and stable friction coefficient. The wear rate of sample C1 decreased by about 38% compared with that of sample C0. The analysis of the worn surface by SEM and EDS showed that the ZnO nanorods were polished gradually and then fractured without peeling off as a whole from carbon fiber leading to excellent tribological performance. The development of an aligned

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