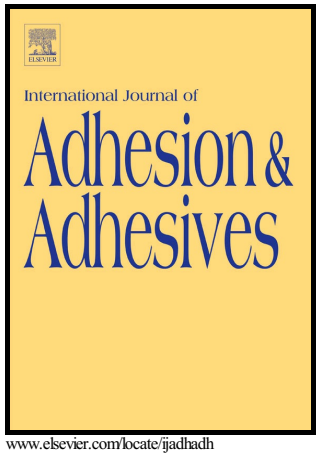

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Nanoreinforced epoxy and adhesive joints incorporating boron nitride nanotubes

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Abstract

Boron nitride nanotubes (BNNTs) offer complimentary properties to carbon nanotubes (CNTs) and interact more favorably with epoxies than do CNTs. This could make BNNTs the preferred nanotube for reinforcing epoxy when electrical conductivity is not required, and particularly where features such as transparency/color, neutron absorption or electrical insulation are advantageous. Here we report epoxy nanocomposites containing 1 to 7 wt% raw BNNTs. The elastic modulus and fracture toughness increased progressively with loading up to 5 wt% BNNTs. Adhesive joints (ASTM D1002) indicated average improvements of ~10% in joint strength at 2 wt% raw BNNTs, but substantially reduced strength for a 5 wt% BNNT adhesive joint. Observation of the failure surfaces suggests that BNNTs impede crack propagation leading to increased joint performance despite a mixed-mode failure with a substantial contribution from adhesive failure. BNNTs purified by removing the elemental boron impurity were more effective, yielding 15% joint strength improvements at 1 wt% loading. This nanocomposite is also semi-transparent, showing the potential for reinforced, electrically insulating, transparent adhesives based on BNNTs.

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