

Effect of moisture and temperature on the mechanical properties of an epoxy reinforced with boron carbide

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Abstract— The degree of degradation in a polymer composite is directly related to the amount of moisture it absorbs. Plasticization and swelling are among the undesirable consequences of absorbed water. This effect is rather important in materials under severe requirements. The use of these composites as coatings requires studying changes in their properties. For this reason, the aim of this work was to study the effect of moisture and temperature on the mechanical properties of an epoxy reinforced with boron carbide. Different B₄C particle sizes (7 and 23 μm) were studied, and the carbide used was 6 wt%. The specimens were exposed to two moisture environments (50 and 95% RH) at 60°C to quantify composite degradation level. Shore D hardness, three-point bending, and pin-on-disk wear tests were used to determine the effect of humid environments. Mechanical properties were determined at several exposure time intervals. Besides, the degradation process was analysed with differential scanning calorimetry (DSC) and infrared spectroscopy (FTIR-ATR).

A general loss of properties was observed after water absorption. However, most cases showed recovery after the drying process, depending on the amount of water remaining in the material, which acts as a plasticiser, particularly improving strength.

Index Terms— Composite materials, degradation, mechanical properties, boron carbide

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