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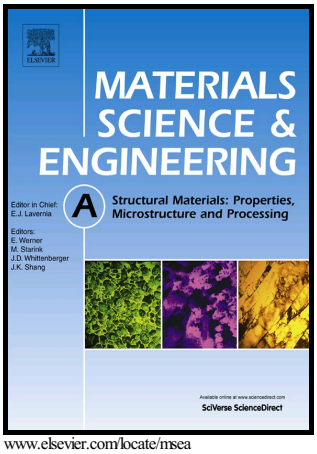

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Foldcore sandwich structure formed by BN-coated graphene nanosheets grafted to SiC fibers with enhanced mechanical performance

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ABSTRACT

To improve the strong interface between fibers and ceramic matrix in silicon carbide (SiC) fibers reinforced in ceramic matrix composites (CMCs), tremendous efforts have been devoted to the fabrication of fiber coating. However, the design and preparation of these fiber coatings still remain a considerable challenge. In this study, we report a novel strategy to synthesize foldcore sandwich structure formed by boron nitride (BN)-coated graphene nanosheets (GNS) grafted to SiC fibers and analyze how the presence of GNS/BN composite coatings influences the mechanical performance of the fibers. In the fracture process, GNS-grafted SiC fibers coated with BN provide a specific wrinkled and malleable surface, which can be flattened and then broken in the early fracture stage. As a result, the fracture process is changed, resulting in enhanced mechanical performance. Our strategy could be further extended to the fabrication of other composite coatings on fibers with enhanced mechanical properties.

Keywords: foldcore sandwich structure; graphene nanosheets; boron nitride; composite coatings; fracture process; mechanical performance

1. Introduction

Over the past ten years, silicon carbide (SiC) fibers reinforced in ceramic matrix composites (CMCs) have attracted widespread interest owing to their superior qualities, such as high oxidation resistance, high thermal stability, and high corrosion resistance. However, one notable feature in these CMC materials is the strong interface between fibers and matrix materials, usually resulting in failure to transfer load from the matrix to the fibers and harming fracture strength and toughness [1-4]. An alternative approach is developed by preparing coatings on the fiber surface [5,6]. h-BN with layer structure used as effective coating materials can establish a weak interface between fibers and ceramic matrix [7-10]. Today, numerous studies have successfully prepared h-BN coatings on SiC fibers by two main methods, including chemical vapor deposition (CVD) method [11-13] and dip-coating method [14-16]. In our previous research, h-BN coatings were prepared on both quartz fibers and SiC fibers and the whole preparation process of h-BN coatings with boric acid and urea