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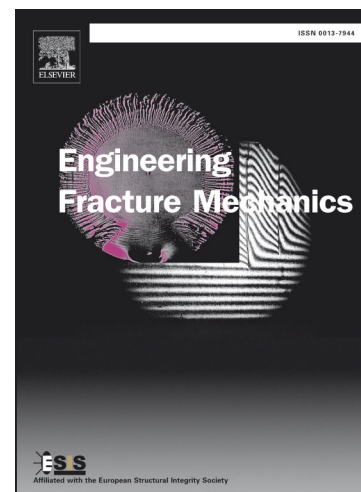
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How fracture toughness of epoxy-based nanocomposite is affected by PA66 electrospun nanofiber yarn

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Abstract

It is of importance to investigate different strategies to improve the poor fracture toughness of epoxies, which are widespread polymeric matrices in composites. In this study, different PA66 nanofiber yarn contents (0.5, 1 and 3 wt %) were used to improve the fracture toughness of the epoxy-based nanocomposite. Fracture toughness was measured using the single edge notched bend (SENB) test. Results showed that by increasing the nanofiber yarn content in the epoxy, the elastic, plastic and the total works as well as the maximum load related to the initiation of crack propagation were improved. Roughness, plastic deformation and interfacial adhesion were investigated via SEM images.

Keywords: Nanofiber yarn, electrospinning, epoxy, fracture toughness, nanocomposite.

1. Introduction

Enhanced mechanical properties of thermoset polymers make them an appropriate candidate for various applications such as engineering components, adhesives and matrix for fiber-reinforced composites [1-3]. Unlike the prominences of these materials, poor fracture toughness limits their performances [4] which can be enhanced by embedding rigid particles such as clay [5], graphene [6], graphite [7], ceramic nanoparticles [8], and carbon nanotubes [9] or taking the advantage of thermoplastic components such as polyamide [10-14], poly(ϵ -caprolactone) [15], polyvinylidene difluoride [16-18], polyacrylonitrile [19] or carbon fibers [20]. Different mechanisms have been used to toughen epoxies by the abovementioned components, i.e. bridging, trapping, particle debonding, fiber pull out, crack deflection, crack pinning, formation or development of the plastic area [21-23].

In this regard, many studies have been conducted by using particles, especially nanoparticles. For instance, a comprehensive experimental and theoretical review was carried out by Fu et al. [24] on micro and nanoparticle reinforced composites. Their results revealed that composite strength and toughness are highly impressed by particle size, particle/matrix adhesion and particle volume fraction which were in agreement with strength dependency on

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