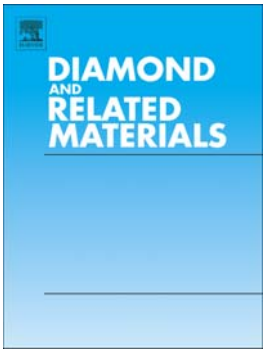

Study on the reinforcing effect of nanodiamond particles on the mechanical, thermal and antibacterial properties of cellulose acetate membranes

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Study on the reinforcing effect of nanodiamond particles on the mechanical, thermal and antibacterial properties of cellulose acetate membranes

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Abstract

The aim of this study was to determine the impact of detonation nanodiamond (DND) on the mechanical, thermal and antibacterial properties of cellulose acetate (CA) membrane. In order to achieve an efficient dispersion of DNDs in the polymeric matrix, they were functionalized via heat treatment. Different amounts of raw and functionalized DND; 0 to 0.75 wt.%, were added to the CA and various structural and characterization analyses such as scanning electron microscopy (SEM), transmission electron microscopy (TEM), thermal gravimetric analysis (TGA) and Fourier transform infrared (FTIR) were also carried out. Mechanical strength analysis revealed that both raw and carboxylated DND have great influence on the mechanical behavior of CA membrane particularly at 0.5 wt.% of nanoparticles (NPs) content. Application of Pukanszky's model for tensile strength and micromechanical models for tensile modulus revealed that strong interfacial interaction and thick interphase region are formed around the NPs. In addition, the TGA results showed that the incorporation of 0.5 wt.% of the DND and DND-COOH improved the thermal stability of the CA membrane. The antibacterial tests confirmed that the nanocomposite membranes containing DND-COOH displayed greater antibacterial enhancement against *Escherichia coli (E. coli)* and *Staphylococcus aureus* (*S. aureus*).