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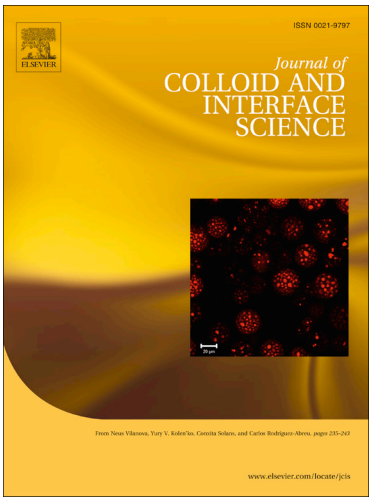

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Transparent, conductive, and superhydrophobic nanocomposite coatings on polymer substrate

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Abstract

Transparent, conductive, and superhydrophobic nanocomposite coatings were fabricated on the polyethylene terephthalate substrate by a spray method. Different concentrations of multi-walled carbon nanotubes (MWCNTs) entwined with SiO_2 nanoparticles, which originated from the hydrolysis and condensation of tetraethyl orthosilicate, were sprayed to form MWCNTs/SiO_2 nanocomposite coatings. The coatings were characterized by scanning electron microscopy, contact angle measurements, and other analytical techniques. The surface morphology, hydrophobicity, transparency, and conductivity of the nanocomposite coating were found to be strongly dependent on the MWCNT concentration. With increasing MWCNT concentration, the hydrophobicity increased first and then decreased, and the optical transmittance and sheet resistance decreased. The enhanced hydrophobicity was associated with the surface microstructure and chemical composition of the coating. The decreased hydrophobicity resulted mainly from the decrease in the trapped air between the water droplet and the nanocomposite coating. Owing to the hierarchically porous 3-dimensional microstructure and opportune fluorinated MWCNT content, the nanocomposite coating with 0.2 wt. % MWCNTs exhibited the best hydrophobicity with a contact angle of 156.7°, good transparency with 95.7 % transmittance and relatively high conductivity with a sheet resistance of 3.2×10^4 Ω sq^{-1}.

Keywords: Transparent, Conductive, Superhydrophobic, Nanocomposite coating, Fluorinated MWCNTs, SiO_2 nanoparticle

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