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The effect of dopamine modified titanium dioxide nanoparticles on the performance of Poly (vinyl alcohol)/titanium dioxide composites

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Abstract

In order to improve the dispersion of nanoparticles (NPs) and enhance the interfacial interactions between NPs and Poly (vinyl alcohol) (PVA) matrix, the surface of titanium dioxide (TiO_2) was modified by green and biocompatible dopamine (DA). PVA composites containing TiO_2 or modified TiO_2 (DA-TiO_2) were fabricated through simple one-step method. The as-prepared composites were characterized by transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray diffraction (XRD), tensile experiments and thermogravimetric analysis (TGA). The TEM images demonstrated that DA-TiO_2 NPs were dispersed well in the PVA matrix, which may originate from the hydrogen bonding and covalent bond formed between PVA and DA-TiO_2 NPs. The tensile experiments exhibited significant improvement for the mechanical properties of PVA composites with proper amount of DA-TiO_2 NPs. Especially, the PVA composites with 1 wt% DA-TiO_2 NPs displayed the desired consequences in terms of tensile strength and toughness, compared to the pure PVA, which were increased by 47.9% and 145.2%, respectively. The TGA curves showed that DA-TiO_2 NPs enhanced the thermal stability of PVA. Additionally, PVA/DA-TiO_2