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Research article

Impact of polymer molecular weights and graphene nanosheets on fabricated PVA-PEG/GO nanocomposites: Morphology, sorption behavior and shielding application

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Abstract: Molecular weight (Mw) is an important feature that affects the physicochemical properties of polymers and their matrices. This study focused on the impact of increasing the Mw of polyethylene glycol (PEG) (4, 8 and 20 K) mixed with polyvinyl alcohol (PVA). Graphene oxide (GO) nanosheets were employed to reinforce the polymer matrix by aquatic mixing-sonication-casting to prepare the nanocomposites and investigate their optical properties. Fourier transform infrared spectroscopy revealed strong interfacial interactions among the components and successful fabrication of the nanocomposites. Optical microscopy and scanning electron microscopy confirmed the fine homogeneity of the polymers and the excellent dispersion of nanosheets in the matrix. The absorption peak was located in the ultraviolet region related to GO. PEG Mw and GO additive significantly improved optical properties such as absorbance, real and imaginary dielectrics and the absorption coefficient constant up to 75%, 40%, 120% and 77%, respectively. An enhancement in the optical properties was also observed after the energy gap values for allowed and forbidden transitions were improved up to 90% and 375%, respectively. These findings suggest the potential of these materials for several applications, such as in photovoltaic devices and heavy metal ion absorption for nuclear waste management.