Title

Influence of TiO2 nanofiller geometry on the rheological and optical properties of poly(acrylic acid)-based nanocomposite hydrogels

Abstract

The properties of macroscopic polymer nanocomposites are highly dependent on the nanoparticle–polymer interfacial region, which varies with the morphology of the nanoparticles. Herein, we used TiO2 nanofillers with very low aspect ratio, the same chemical composition, and surface functions, but different geometries (nanospheres and nanoplates) dispersed in a poly(acrylic acid) matrix to analyze the influence of the nanoparticle geometry on the properties of nanocomposite hydrogels. The geometry was found to affect the swelling and rheological properties of the nanocomposite polymers. Particularly, the yield strain (from 25% to 130%), modulus (from 17,500 to 25,000 Pa), and brittleness of nanoplates based nanocomposite increased more significantly. Finite-difference time-domain simulations demonstrated that nanoplates increased the wavelength of the absorption maxima (224 nm for NS to 240 nm for NP) and charge distribution. The results obtained in this research indicate that the nanofiller shape markedly influences the rheological properties of the nanocomposite polymers, opening the door to further research focused on polymer–nanofiller interactions, and their effect on the macroscopic properties of the nanocomposites.

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