Abstract

$ZnO\text{-}TiO_2$ nanocomposites were synthesized via sol–gel technique in varying sol pH and the effects of pH on the composites' properties studied. The variation of crystallinity with pH was determined using the X-ray diffraction (XRD), particle morphology by both scanning electron microscopy (SEM) and transmission electron microscopy (TEM) techniques. UV–Visible diffuse reflection spectroscopy (DRS) and photoluminescence (PL) were used for the optical characterization whereas the Fourier transform infrared was used to determine the chemical bonds. Nitrogen adsorption–desorption was used for the textural properties. The obtained crystallite sizes ranged between 16.7–28.5 nm with the largest sizes at pH 4 while SEM and TEM images revealed particles of different morphologies observed at different pH levels. For the $ZnO\text{-}TiO_2$ catalyst synthesized at pH1, a mixture of rod-like particles with trace agglomerations composed much smaller particles were formed. In all the other pH values, varied sizes of spherical particles were seen. The optical properties divulged band gaps that were governed by the obtained crystallite sizes. It was noted that the smallest Eg was recorded at pH 4 and was well-matched with the highest intensity of PL emission. Photocatalytic tests conducted also confirmed that by direct control of the crystallite sizes and the bandgap by varying the sol pH, photodegradation rate can be increased. The highest rate was obtained at pH 4 attributed to higher crystallinity and strong porosity as compared to the other pH levels.