Nanostructured $K_xNa_{1-x}NbO_3$ hollow spheres as potential materials for the photocatalytic treatment of polluted water

Praxedes F.R.
Nobre M.A.L.
Poon P.S.
Matos J.
Lanfredi S.

Abstract
Potassium-sodium niobate-based hollows spheres were studied in the photocatalytic degradation of Basic Blue 41 dye in aqueous phase under UV irradiation. $K_xNa_{1-x}NbO_3$ materials were prepared at 700 °C by the spray pyrolysis method. Photocatalysts were characterized by XRD, SEM, TEM, N_2 adsorption/desorption isotherms and FTIR. Different kinetic models of adsorption, direct photolysis, and photocatalytic degradation of the azo-dye were performed as a function of the pH of solution. The increase in potassium content is responsible of the distortion and polarization of the niobate structure promoting a decrease in the energy band-gap down to 3.01 eV for $K_{0.5}Na_{0.5}NbO_3$. The photocatalytic activity observed on $K_{0.5}Na_{0.5}NbO_3$ was up to 23 times higher than that on TiO_2 in terms of the surface concentration of the azo-dye molecules adsorbed. A mechanism for the degradation of Basic Blue 41 azo-dye based on the reactive oxygen species detected by scavenger's tests and mass-spectroscopy analysis was proposed.

Author keywords
Basic blue 41; Hollow spheres; $K_xNa_{1-x}NbO_3$ photocatalysts; Ultrasonic spray pyrolysis