HYDROTHERMAL SYNTHESIS AND CHARACTERIZATION OF ONE-DIMENSIONAL TITANATE-BASED NANOSTRUCTURES

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Typical hydrothermal reaction of TiO_2 and aqueous solution of NaOH yields formation of one-dimensional titanate-based nanostructures. Formation of one-dimensional titanate based nanostructures such as nanotubes, nanobelts and nanorods depends on the synthesis conditions. The layered, lamellar materials such as layered titanates with general formula $A_2Ti_nO_{2n+1}$ (A = H, Na, K and n = 2-6) and $A_xTi_{2-x/4}\square_{x/4}O_4$ (A = Na, H, Cs □ = vacancy) commonly undergo two kinds of topochemical reactions. In the first type of reaction, the layered structure of titanates enables intercalation of various species into interlayer galleries, while the morphology is preserved. The second type of reaction is exfoliation of sheets of the host material due to the intercalation. Based on known photocatalytic properties of TiO_2, many investigations have been initiated to study nanostructured titanates for similar photocatalytical processes. Intercalation of various species (alkaline, earth alkaline and transition metal cations, semiconductive nanoparticles) enables functionalization of one-dimensional titanates for possible applications in photocatalysis, in photodecomposition of water, as a gas sensors etc..
Hydrothermally synthesized one-dimensional nanostructures were used as a template in further hydrothermal ion-exchange reactions. The morphology, the composition and the crystal structure of hydrothermally synthesized one-dimensionally nanostructured products were determined using high-resolution transmission electron microscopy (HRTEM), energy-dispersive x-ray spectroscopy (EDS) and electron diffraction (ED).