

Chemical composition and phase identification of sodium titanate nanostructures grown from titania by hydrothermal processing

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Abstract

Fine titanium dioxide particles were hydrothermally treated in a sodium hydroxide aqueous solution. The treatment extended from 1 to 6 days leading to belt-like and wire-like structures of a metastable phase of sodium titanate, with typical widths and diameters between 8 and 40 nm, and lengths from 100 nm to several micrometers. These conclusions are supported by X-ray photoelectron spectroscopy, X-ray diffraction, Raman spectroscopy and high resolution transmission electron microscopy. The latter method revealed two set of space fringes with characteristic distances of 0.29 and 0.34 nm. These distances could correspond to the lattice spacing of $[-311]$ and $[-111]$ planes in $\text{Na}_2\text{Ti}_6\text{O}_{13}$ compounds. The nanomaterial was found to be stable up to temperatures as high as 200 or 400°C depending on the reaction time and the concentration.