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The effects of TiO_2 phase and grain size on synthesis of nano-potassium titanate using solid-state reaction

Seyed Davood Tavosi and **Hamid Reza Javadinejad**
Islamic Azad University, Najafabad, Iran

In this study, the mechanism of potassium titanate was investigated using X-ray diffraction (XRD), thermodynamic and thermogravimetric analysis. Titanium dioxide nanoparticle (TiO_2) having anatase phase and potassium carbonate (K_2CO_3) were used to synthesis potassium titanate. Before carrying out synthesis reactions, titanium dioxide powders were mechanically activated for 5, 17 and 24 hours. The synthesis reactions were performed under non-isothermal conditions and heating rate of 10°C/min in thermogravimetric analyzer (TG). Regarding synthesized potassium titanate properties, effects of grain size, crystalline structure and mechanical alloying were studied on the product composition and structure. The results showed that mechanical activation of anatase powders under different times leaded to transiting anatase to rutile phase and consequently, formation of various potassium titanates. X-ray diffraction and scanning electron microscopy equipped with Energy-dispersive X-ray spectroscopy confirmed that using anatase leaded to form potassium dititanate (K_2Ti_2O5), while the product of reactions between rutile and potassium carbonate was potassium mono titanate (K_2TiO_3). Thermograms recorded at 10°C/min shows an obvious difference between samples, having different phase of titanium dioxide, which indicated dissimilar kinetic and thermodynamic mechanism.

Tavosi.davod@yahoo.com

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