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Synthesis and Characterization of Nanocrystalline PbTiO<sub>3</sub>

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Abstract

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
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## Abstract

Nanocrystalline PbTiO<sub>3</sub> in tetragonal form has been successfully prepared via a newly developed environmentally friendly coprecipitation process. The formation process of lead titanate from the PbC<sub>2</sub>O<sub>4</sub>·TiO<sub>2</sub> precursor was monitored using DTA-TG, XRD, FT-IR, and TEM techniques. XRD showed the phase transition of less stable tetragonal PbO decomposition intermediate to a more stable orthorhombic structure by raising the calcination temperature. For the precursor calcined at 600 °C, only XRD lines characteristic of nanocrystalline tetragonal PbTiO<sub>3</sub> are detected. TEM of PbTiO<sub>3</sub> nanocrystals showed agglomerates with diameters in the range 85-90 nm. Consistent with the TEM result, the grain size estimated using surface area measurements indicated a high degree of particle agglomeration. FT-IR measurements gave results which are in close agreement with those revealed by XRD technique. The ac conductivity of PbTiO<sub>3</sub> depends on the dielectric property. The kinetics of the nonisothermal TG curves for the precursor decomposition was carried out assuming various solid-state-reaction models and applying three different computational methods. The data analysis showed that the presence of TiO<sub>2</sub> during oxalate decomposition reaction does not alter the decomposition mechanism; it drastically affects the activation parameter values.

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