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Investigation into the Optical and Dielectric Characteristics of TiO₂ Nanocrystals Synthesized Via the Pechini Technique

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Abstract

The optical and dielectric properties of TiO₂ nanocrystals generated by the Pechini process are examined in this research study. The goal of the research is to comprehend the basic characteristics of these nanocrystals, which are essential for a variety of purposes in industries like electronics and catalysis. The Pechini process was used to create titanium oxide nanocrystals, which were then calcined at temperatures between 300 and 1000 C. Raman spectroscopy, scanning electron microscopy (SEM), and X-ray diffraction, were used to analyze the crystalline structure. At temperatures close to 500 C, a phase transition from the anatase to rutile crystalline phase was discovered. Dielectric spectroscopy and photoluminescence (PL) were used to characterize the samples. It is described how the calcination temperature affects near-infrared and visible luminescence. There is discussion of the relationship between the structural, luminescent, and dielectric properties. This work opens the door for more investigation into the functional traits of nanocrystals in a variety of technical fields and advances our understanding of their qualities.

Keywords: Sol–Gel Processes, Impedance, Optical Properties, TiO₂, Scanning electron microscopy, Photoluminescence.

