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## Decreasing of the activation energy of TiO<sub>2</sub> nanoparticles by applying ultrasound waves using the sol-gel method

H Milani Moghaddam<sup>1,2</sup> and S Nasirian<sup>1,2,3</sup>

1. Physics Department, University of Mazandaran, Babolsar

2. Molecular Electronics Lab., University of Mazandaran, Babolsar

3. Basic Sciences Department, University of Science & Technology of Mazandaran, Babol

E-mail: milani@umz.ac.ir

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### Abstract

In this letter, titanium dioxide nanoparticles (TiO<sub>2</sub>) were synthesized via a sol-gel method and combining titanium tetrachloride (TiCl<sub>4</sub>) and ethanol. The activation energy was investigated on the phase transformation from anatase to rutile in the presence and absence of ultrasound waves. The anatase nanocrystallites were only crystallized up to the calcination of 500 °C. By increasing the calcination in the region after 500 °C, rutile nanocrystallites grew in samples, and mixed-phase TiO<sub>2</sub> nanoparticles were obtained. Our results show that applying ultrasound waves decreases both onset transition temperature and the activation energy of the phase transformation from anatase to rutile. The activation energy showed a considerable reduction at about  $18.5 \frac{\text{kJ}}{\text{mol}}$  by applying the ultrasound waves.

**Keywords:** Titanium dioxide nanoparticles, sol-gel method, ultrasonic waves, activation energy

For full article, refer to the Persian section