

## Microwave Assisted Sol-gel Synthesis And Characterization Of Nanocrystalline Zirconia

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**Abstract :** Zirconia nanoparticles have gained significant attention due to their excellent mechanical strength, thermal properties, biocompatibility, and catalytic activity. Tetragonal zirconia holds the greatest efficacy for surgical implants and coatings when it comes to the three zirconia phases (monoclinic, tetragonal, and cubic). However, its stability at higher temperatures and transformation to the monoclinic phase upon cooling are challenging. In this research, zirconia nanoparticles were prepared using microwave-assisted sol-gel method with varying microwave powers (100 W, 300 W, 500 W, 700 W, & 900 W). Organic stabilizing agent, i.e., eggshell powder, was used to stabilize the tetragonal phase. Fourier transform infrared spectroscopy (FTIR) confirmed the phase-pure tetragonal zirconia, corroborating the XRD data. Optical properties, including the optical bandgap, were studied using UV/Visible and PL spectroscopies. The synthesized ZrO<sub>2</sub> nanoparticles exhibited excellent photocatalytic degradation efficiency in the degradation of methylene blue (MB) dye under UV irradiation. The findings demonstrate the potential of these ZrO<sub>2</sub> nanoparticles as a viable alternative photocatalyst for the efficient degradation of various dyes in contaminated water.

**Keywords :** zirconia nanoparticles, sol-gel, photocatalysis, water purification

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