

## Role of Post-irradiation Dielectric, Electrical, Optical and Ferroelectric Properties of LZO in Electron and Gamma Irradiations

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### Abstract

Radiation-induced modifications in functional materials are important for understanding their suitability for electronic, optical, dielectric, and radiation-resistant applications. Lanthanum zirconate (LZO) is a technologically significant oxide material with useful structural, dielectric, optical, and ferroelectric-related characteristics. This study investigates the post-irradiation dielectric, electrical, optical, and ferroelectric properties of LZO subjected to electron and gamma irradiations. Exposure to energetic radiation can generate defects, vacancies, charge traps, and other structural modifications that may alter the electronic structure and polarization behaviour of the material. The dielectric response of irradiated LZO can be evaluated through changes in dielectric constant, dielectric loss, frequency dependence, and conductivity. Electrical characterization provides information about charge transport, defect-assisted conduction, and radiation-induced changes in resistive behaviour. Optical investigations can reveal variations in absorption, transmission, optical band gap, and defect-related optical states resulting from irradiation. Ferroelectric characterization may further provide insight into changes in polarization, remanent polarization, coercive field, and hysteresis behaviour. Comparative analysis of electron- and gamma-irradiated samples can help identify differences in the mechanisms and extent of radiation-induced modification. Digital data analysis and computational modelling can support the interpretation of experimental results and establish relationships between irradiation conditions and material properties. Understanding these changes is important for assessing the stability and performance of LZO under radiation environments. The study highlights the potential of systematic post-irradiation characterization for developing radiation-tolerant dielectric and functional oxide materials for advanced electronic and energy-related applications.

**Keywords:** Lanthanum Zirconate, LZO, Electron Irradiation, Gamma Irradiation, Dielectric Properties, Electrical Properties, Optical Properties, Ferroelectric Properties, Radiation Effects, Defect States.