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Review of Rare Earth Ionic Radius on Structural Phase Stability and Electrical Behavior of SR(R1/3NB1/2)O3 Ceramics

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Abstract: *The present study investigates the influence of rare earth ionic radius on the structural phase stability and electrical behavior of $Sr(R_{1/3}Nb_{1/2})O_3$ (SRN) ceramics. A series of SRN ceramics doped with different rare earth ions (R = La, Nd, Sm, Gd, and Dy) were synthesized using the conventional solid-state reaction method. The variation in ionic radii of the substituted rare earth elements significantly affects the tolerance factor, lattice distortion, and phase formation of the ceramics. X-ray diffraction analysis confirms the formation of perovskite structure with phase transitions influenced by the decreasing ionic radius of the rare earth ions.*

Microstructural studies reveal changes in grain growth behavior and densification, which are strongly correlated with ionic size. Electrical characterization demonstrates that dielectric constant, loss tangent, and conductivity are sensitive to the structural modifications induced by ionic substitution. The results indicate that larger ionic radius rare earth elements promote enhanced phase stability and improved dielectric properties, while smaller ions introduce lattice strain leading to altered electrical conduction mechanisms. This study highlights the critical role of rare earth ionic size in tailoring the structural and electrical properties of SRN ceramics for potential applications in electronic and energy storage devices..

Keywords: Rare earth ions, Ionic radius, Perovskite ceramics