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“Annealing temperature influence on sol-gel processed zirconium oxide thin films for electronic applications”

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Abstract

A study of zirconium oxide (ZrO_2) thin films obtained by the non-alkoxide sol-gel method at different annealing temperatures, up to $450^\circ C$, is presented. Morphological, compositional, and optical characterizations of zirconia thin films show high transparency and high bandgap, besides homogeneous and non-porous surface. Metal-insulating-metal (MIM) devices were assembled from this zirconia material for electrical characterizations and have shown high electric resistivity and high specific capacitance. A study of the thin film composition shows residues of S and Cl elements from the precursor solution that contributes for reduction of the dielectric constant of the zirconia thin films, even though they still present higher values when compared to SiO_2 , which is a positive alternative to replace this oxide in electronic devices. A parallel study of MIM assembled on polymeric substrate and annealed at $100^\circ C$ also leads to positive results concerning high electrical insulating and capacitance. This study aims the understanding of the relations between annealing temperature and impurities found in sol-gel based thin films, as well as their relations to dielectric characteristics of zirconia thin films that impact the final properties of electronic devices, such as in field effect transistors.

Keywords: ZrO_2 , dielectric, annealing effect, sol-gel.

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