

Microstructural and nonlinear properties of Zn-V-Mn-Nb-O varistor ceramics with Gd₂O₃ substitution for low voltage application

ABSTRACT

The effect of Gd₂O₃ substitution on the microstructural and electrical properties of Zn-V-Mn-Nb-O varistor ceramics sintered at 900°C was investigated. XRD, SEM, and EDAX results show that the GdMnO₃ and GdVO₄ phases formed at the grain boundaries and triple point junctions. Gd₂O₃ substitution inhibited the grain growth from 3.85 to 3.06 μm and increased the sintered ceramics density from 5.12 to 5.19 g/cm³. The samples containing the amount of 0.03 mol% Gd₂O₃ exhibit an optimum nonlinear coefficient α value which is 9.91, highest breakdown electrical field which is 88.48 V/mm and lowest leakage current density which is 0.11 mA/cm² in low voltage application.

Keyword: Electrical properties; Gd₂O₃; Low voltage varistor; Microstructure; Zinc oxide