

Microstructure and nonlinear properties of Zn-V-Mn-Nb-O varistor ceramics with Nd₂O₃ substitution

ABSTRACT

An abnormal grain growth of the ZnO-based ceramics due to highly reactive vanadium liquid phase disrupts its nonlinear properties. The effect of Nd₂O₃ concentration from 0.01 to 0.05 mol% on microstructure and electrical properties of ZnO-based varistor ceramics were investigated. The sample was fabricated via solid state method and sintered at 900 °C for 2 h. XRD analysis shows the V₂O₅ and Zn₂Nb₂Mn₂O₉ phase formation. SEM analysis shows the grain is more uniform and enlarged to 3.54 μm with Nd₂O₃ addition up to 0.03 mol%. Nd₂O₃ also increased both the nonlinear coefficient α and the breakdown electric field, E_{1mA} to an optimum of 9.94 and 75 V/mm. Beyond that concentration, oxygen O vacancy formed at the grain boundary and diminished the electrical properties.

Keyword: ZnO; Nd₂O₃; Low-voltage varistor