

The effect of sintering time on the microstructural and nonlinear electrical properties of Zn-V-Mn-Nb-Nd-O low-voltage varistor ceramics

ABSTRACT

There is lacking of study on the prolonged sintering time effect on the microstructural and nonlinear electrical properties of ZnO-V₂O₅-MnO₂-Nb₂O₅-Nd₂O₃-based low-voltage varistor ceramics sintered at 900 °C. The aim of this study is to investigate the effect of sintering time from 120 to 210 mins on the microstructural and nonlinear properties of the ceramics. It is expected that its properties is diminished as sintering time is increased. The sample was prepared by solid-state method and sintered at 900 °C. The XRD diffraction peaks detected V₂O₅ as secondary phase. The ZnO peak shifted to the low diffraction angle of 34.37° and increased the interplanar space slightly to 2.61 Å. The average grain size decreased to 2.67 μm and density decreased to 4.74 g/cm³ as sintering time increased to 180 mins. However, the presence of liquid phase at 210 min increased both value to 3.63 μm and 5.00 g/cm³. The nonlinear α value decreased to 5.74 since the barrier height decreased to 0.633 eV as sintering time increased. The value of leakage current density J_L increased to 0.54 mA/cm² as sintering time increased up to 180 mins but decreased to 0.42 mA/cm² at 210 mins. The breakdown field E_{1mA} value also decreased from 76.07 to 66.03 V/mm as sintering time increased.