

Photothermal Radiometry Characterization of Zinc Oxide Based Varistors Doped with Antimony Oxide

Carolina Tabasco^{C, S}, José Fernando May-Crespo, Patricia Quintana and Juan José Alvarado-Gil
Department of Applied Physics, CINVESTAV-IPN, Mérida, Yucatán, México
ctabasco@mda.cinvestav.mx

Alexander López-González
Facultad de Ingeniería, Universidad Autónoma de Chiapas, Tuxtla Gutierrez, Chiapas, México

Zinc oxide varistors are voltage-limiting ceramics devices with highly nonlinear resistance, used as overvoltage surge protection in electrical circuits. ZnO-based varistors are semiconducting ceramics fabricated by sintering of ZnO powders with small amounts of additives to enhance the non-linearity of the varistor's behavior. The origin of their non-ohmic behavior lies in their microstructure, where ZnO grains are three-dimensionally separated from each other by grain boundary layers formed by the reactions of additives with each other and with ZnO. The electrical properties are so sensitive to the microstructure because the breakdown voltage is related to the grain size. The microstructure, electrical and thermal properties of ZnO based varistors both depend on type and content of dopant as well as the method of formulating ZnO and the processing condition [1-3]. In this work, photothermal radiometry is used to obtain the thermal diffusivity of ZnO and ZnSb₂O₆ performed by a traditional ceramic method and sol-gel method. Also the heat capacity and the thermal conductivity are determined. The correlation of the obtained thermal properties and the I-V response and nonlinear coefficient is investigated. The study is complemented by X-ray diffraction (XRD) and scanning electron microscopy (SEM).

References

- [1] Microstructure and electrical properties of rare earth doped ZnO-based varistor ceramics. Ji-le Li, Guo-hua Chen, Chang-lai Yuan. *Ceramics International* 39 (2013) 2231-2237.
- [2] Grain growth of ZnO-V₂O₅ based varistor ceramics with different antimony dopants. Zhao Ming, Shi Yu, Tian Chang Sheng. *Journal of the European Ceramic Society* 31 (2011) 2331-2337.
- [3] Effect of antimony oxide stoichiometry on the nonlinearity of zinc oxide varistor ceramics. S. Ezhilvalavan, T.R.N Kutty. *Materials Chemistry and Physics* 49 (1997) 258-269.