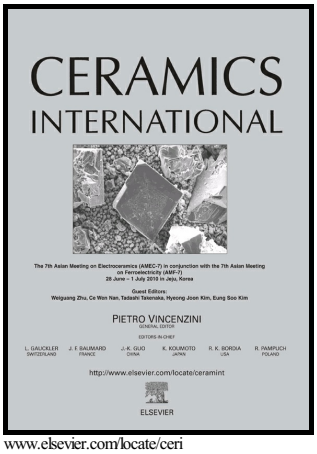

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PII: S0272-8842(18)30231-1
DOI: https://doi.org/10.1016/j.ceramint.2018.01.218
Reference: CERI17350

To appear in: *Ceramics International*

Received date: 5 September 2017
Revised date: 22 January 2018
Accepted date: 26 January 2018

Cite this article as: M. Gririraj, K. Murugan, Niroj K. Sahu and K. Hembram, High Performance Multi-Layer Varistor (MLV) from Doped ZnO Nanopowders by Water Based Tape Casting: Rheology, Sintering, Microstructure and Properties, *Ceramics International,* https://doi.org/10.1016/j.ceramint.2018.01.218

High Performance Multi-Layer Varistor (MLV) from Doped ZnO Nanopowders by Water Based Tape Casting: Rheology, Sintering, Microstructure and Properties

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Abstract

In this work, we report the fabrication of a high performance multi-layer varistor (MLV) via water based tape casting method using novel compositions of nanomaterials. Bi_2O_3, CaO and Co_3O_4 doped ZnO nanopowders were prepared by solution combustion synthesis (SCS) route, calcined at different temperatures (550, 650, 750 and 850 °C) and characterized by TEM, XRD, SEM and AFM. The nanopowder (crystallite size ~30 nm) calcined at 650 °C for 1h was used as the starting material for MLV fabrication. Compositions of the slurry containing doped ZnO nanopowders, binder and plasticizer in water solvent were optimized for the fabrication of thick film. The rheological properties of the slurries having different solid loadings were analysed and thick films of various thicknesses (50-500 µm) were prepared by varying the feeding rate of tape casting. The film roughness of 38.3 nm for the thick film made from 40 wt.% solid slurry was found to be superior compared to other samples due to the presence of reduced crack and shrinkage. MLV fired at 950 °C for 1.5 h exhibited a coefficient of nonlinearity of 18 and breakdown voltage of 291.5 V that yields superior properties compared to commercial MLVs.

Keywords: *ZnO nanopowders, doping, viscosity, slurry, thick film, sintering, electrical properties, coefficient of nonlinearity, breakdown voltage*

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