International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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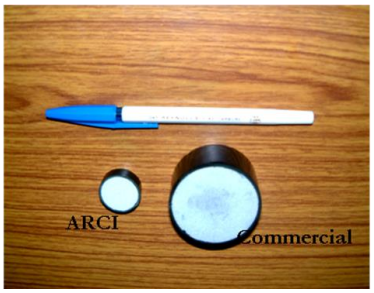
High Performance Varistors made from Doped ZnO Nanopowders

Overview

ZnO varistors is a polycrystalline ceramic over-voltage protection device whose primary function is to sense and regulate over voltage surge. The device is used in small electronics circuits to large transmission lines due to its high nonlinear current-voltage characteristics with large energy dissipation capabilities. ARCI have developed high performance varistors from nanopowders using novel process and compositions. The process of making doped ZnO nanopowder is very simple (single step) and cost effective. The synthesis parameters and compositions have been optimized for lightening arrestor application at pilot scale level. These nanopowders can be sintered at much lower temperatures with lesser time compared to commercial micron-powders. Breakdown field of 21 kV/cm, low leakage current density of 0.7 μA/cm^2 and coefficient of nonlinearity greater than commercial (90) have been obtained.

Key Features

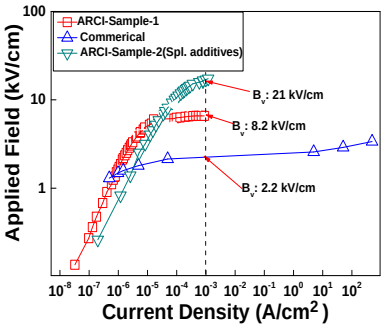
- Patented technology
- Lower sintering temperature and time compared to micron powders
- Order of magnitude higher breakdown field, 2-3 times coefficient of nonlinearity and comparable leakage current density



Varistor disc comparison of ARCI and commercial sample

Potential Applications

- Power engineering
- Automobile industry
- Household electronics
- Telecommunications



I-V characteristic comparison of ARCI and commercial varistors

Intellectual Property Development Indices (IPDI)

- Electrical properties tested
- Scale-up to pilot level

Status	1	2	3	4	5	6	7	8	9	10

Major Publications

1. An improved process for the preparation for doped ZnO nanopowder useful for the preparation of varistors, K. Hembram, T.N. Rao and R. Sundaresan, **Indian Patent No. 254913**.
2. Improved composition and method of preparation of high performance ZnO varistors, K. Hembram, A.R. Kulkarni, R. S. Srinivasa and T.N.Rao, **Indian Patent Application No.# 2765/del/2015.**
3. K. Hembram, T.N.Rao, R.S. Srinivasa and A. R. Kulkarni, High performance varistor made from doped ZnO nanopowders by pilot-scale flame spray pyrolyser: sintering, microstructure and properties, Journal of the European Ceramic Society, 35 (2015), 3535-3544.

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