

## Stability of ZnO-Pr6O11-Cr2O3 varistor ceramics against electrical degradation

### ABSTRACT

The vulnerability of varistor ceramics to electrical degradation during operation not only affects their nonlinear properties but also leads to shortening of device's lifetime by increasing the risk of failures including melting, fire or even explosions. In this study, ZnO-Pr6O11-Cr2O3 varistor ceramics were prepared through modified citrate gel method and solid state-sintering at 1250 °C for 1 hour. The stability of their nonlinear properties under prolonged application of DC electrical field in high temperature ambient was investigated. Degradation process was accelerated by applying direct current (DC) electrical field of 15 % below the breakdown field point of ceramics for 54 hours consecutively at temperature of 30 to 125 °C. The findings indicate that ZnO-Pr6O11-Cr2O3 ceramics exhibited its susceptibility to electrical degradation after prolonged electrical and thermal stresses application. Its nonlinear coefficient has reduced by 4.4 % reduction, the breakdown field has reduced by 9.9 % and the leakage current density increased by 13.7 % in comparison to its initial value. Degradation process in varistor ceramics of ZnO-Pr6O11-Cr2O3 was a direct response to collapsed Double Schottky Barrier at ZnO grain boundary.

**Keyword:** Ceramics; Degradation; Zinc oxide varistors