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N. Halawani, J.L. Augé, O. Gain, V. Griseri, G. Teyssèdre, S. Pruvost

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Poly-etherimide epoxy diamine blends: Conductivity and breakdown voltage measurements at room temperature

N. Halawani [1, 2], J.L. Augé *[1], O. Gain [2], V. Griseri [3], G. Teyssèdre [3] and S. Pruvost [2]

[1]Univ Lyon, INSA Lyon, UMR CNRS 5005, AMPERE, F- 69622, Villeurbanne, F rance
[2]Univ Lyon, INSA Lyon, UMR CNRS 5223, IMP Ingénierie des Matériaux Polymères, F-69621, Villeurbanne, France
[3]LAPLACE (Laboratoire Plasma et Conversion d'Energie), Université de Toulouse, CNRS, UPS, INPT; Bat 3R3, 118, route de Narbonne, F-31062 cedex 9, France

*corresponding authors: jean-louis.auge@univ-lyon1.fr

***Abstract*—**This paper presents an investigation on the current and breakdown voltage measurements in thermoset-thermoplastic blends based on an epoxy-amine/poly-etherimide phase separated material. Thermoset-thermoplastic separated blends could be a novel material for insulation applications and can be compared to epoxy/inorganic composites systems. Pure epoxy network as well as the blends with 10 wt% of PEI were studied in terms of conduction and transient currents. An ohmic behavior below the threshold field (E_{th}) and space-charge-limited conduction (SCLC) above E_{th} are pointed out. Contact emission phenomenon was investigated by means of Schottky model and seems to be valid for both materials. The addition of 5 and 10 wt% of PEI into the epoxy system showed an increase in the values of breakdown voltage with the increase of the PEI amount.

Keywords: Epoxy; organic-organic blend; insulating material, electrical properties

I. Introduction

Epoxy resin is a common electrical insulating polymer, which is used in high voltage resin casted transformers, cable terminations and other accessories [1]-[4]. Epoxy composites and epoxy-thermoplastic blends are two types of material combination made of organic – inorganic and organic – organic mixture, respectively, where the epoxy is the major organic matrix in both situations. Both kinds of materials differ in their composition and thus in their characteristics and applications. Epoxy/filler composites are extensively investigated to observe the influence of the fillers on different properties of the epoxy network and precisely the thermal and electrical ones [5]-[8]. The studies can be classified depending on the size of the filler used, being micro-sized, nano-sized or a combination of both micro and nano-sized fillers. Moreover, polymer blends and especially epoxy/thermoplastic blends are also extensively studied to show the influence of incorporating a thermoplastic on the mechanical, thermal and solvent resistance properties of the epoxy network [9]- [12].

Epoxy/inorganic composites, with nano and micro sized fillers, have shown mechanical and thermal improvement and have gained more attention in many applications. The addition of these kinds of fillers in the formulation improves for example fire resistance [5],[7],[13],[14]. Khan et al. showed how the mechanical properties of an