Rheological, Electrical and Thermal Properties of Enhanced Epoxy/silica Composites

Chitral J Angammana[1]*, Ryan J Gerakopulos[1], Shesha H Jayaram[1,2]
[1]NanoQuan Inc
[2]University of Waterloo
e-mail: cangammana@nanoquan.com

***Abstract* — The subject of nanocomposite materials with reinforced filler has been studied extensively in the recent years. Fillers such as silica is commonly incorporated in epoxy formulations used for transformers bushings, to lend specific characteristics including mechanical, electrical, and thermal properties. But, the polar interactions among very small size particles in the range of micro and/or nano scale through hydrogen bonding and Van der Waals forces cause fillers to aggregate into a flocculated network, which is holding back mass production of optimal epoxy/silica composite formulations and products. In the present study, the problems of unwanted agglomeration and filler structure rebuilding have been achieved using a cycloaliphatic epoxy resin and specific formulations of micro and nano sized silica fillers. Experimental results revealed that new epoxy formulations in combination with electrospinning based mixing technology can enhance the heat distortion temperature, abrasion resistance, and electrical breakdown strength of the epoxy composite up to 40%, 40%, and 25% respectively compared to the existing products. In addition, the viscosity or flowability of epoxy-composites was improved five times or greater compared to the conventional formulations enabling new processing capabilities. The results of this work has significant impact on process technologies.**