

## Investigation of the Dielectric Strength of Syntactic Foam at 77 K under DC Stress

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**Abstract** - Liquid nitrogen (LN<sub>2</sub>) based electrical insulation systems for superconducting equipment of electrical power distribution networks are state of the art. Since LN<sub>2</sub> is a cryogenic liquid, it has some disadvantages when used as insulation. This paper deals with syntactic foam as an alternative insulation system for superconducting apparatus. Syntactic foam is a composite material consisting of a polymeric matrix and embedded hollow microspheres with diameters of several 10 µm. As hollow microspheres are gas-filled, using those as filling material features significant reductions of the relative permittivity and of the thermal contraction due to cooling the material to liquid nitrogen temperature (LNT, T = 77 K). In this study both an epoxy resin (ER) and an unsaturated polyester resin (UPR) serve as matrix material. The hollow microspheres used in this investigation are made of untreated and silanized glass. The results of measurements of the dielectric DC strength show, that the dielectric strength of all investigated syntactic foam compositions are significantly higher at LNT compared to ambient temperature (AT). Furthermore, the effect of a higher dielectric strength of syntactic foam with silanized glass spheres at ambient temperature vanishes at LNT. Hence, the dielectric strength at LNT is unaffected by silanization of glass microspheres.

**Keywords** - Syntactic foam, LT insulating systems, dielectric strength