Contribution ID: **88** Type: **Oral Presentation**

# Charge trapping/detrapping characteristics and lifetime of solid dielectrics

*Wednesday, 6 July 2016 10:00 (30 minutes)*

Solid dielectrics have been widely used as insulation in power industry and often experience degradation/aging under hostile operation conditions. Their designed lifetime may be compromised. Therefore, it is important to identify the status of the insulation. Traditionally, the lifetime of solid dielectrics has been estimated using the inverse power law without the knowledge of detailed physical processes that take place in the materials. Recently, both depth and number traps in solid dielectrics have been related to material status as both chemical and physical changes in materials can lead to formation of traps.

In the present paper, a model has been developed that links the charge dynamics with both depth and number of traps in the material. By considering the material degradation/aging as a process of trap generation, it has been suggested that once the number of traps in the material reaches to a critical value the lifetime of the material as an insulation is terminated. By observing charge dynamics it is possible to estimate depth and number of traps. The experimental results also demonstrate that the electrical performance of the materials declines when the number of traps increases. Based on the new model, it can be shown that the empirical inverse power law of lifetime of an insulation can be obtained when the number of traps has a power law relationship with both the applied electric field and the time of the electric field application. That is to say the inverse power law is a special case of the new lifetime model. More importantly, the new model has a clear physical meaning which aid our understanding of aging process.

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**Session Classification:** Oral 1

**Track Classification:** Dielectrics, Insulation, and Breakdown