Real synthetic insulation in HVDC cables: Characterization and modelling of the electric behaviour

Context and Aims of the project :

The challenge in the development of renewable energies such as solar or wind is to transmit energy over long distances, as production areas are generally far from consumptions areas. High Voltage Direct Current (HVDC) is now the preferred technology compared to HVAC, and, among the proposed insulations for HVDC, cross-linked polyethylene (XLPE) is the emerging material. One of the issue using a synthetic insulation is the presence of charges, generated inside or outside the material, and called space charges. The material being resistive, it stores charges for a long time. These charges can locally increase the electric field, leading to material degradation and possible dielectric breakdown, i.e. to the failure of the transmission link. It is then of prime importance to predict the electric field distribution in such HVDC cable systems.

Within this context, the aim of the project is to acquire a detailed knowledge on the charge generation and transport in such HVDC material, in order to model and simulate their behaviour under thermo-electric stress. Mesoscopic scale models featuring physical processes at the nano-to-micrometer scale, and given access to macroscopic values directly measurable experimentally (current, space charge, potential…) have already been developed in the 'Solid Dielectric and Reliability' (DSF) team of the Laplace, and also in Nexans. The models need to be improved to account for intrinsic charge carriers related to chemical residues issued from the cross-linking process, and thought to have a non negligible impact on the electric field distribution. The project combines innovative experiments such as space charge and current, with up-to-date charge transport models.

Keywords : polymer materials, dielectric characterizations, charge transport modelling, High Voltage Direct Current (HVDC)

Project coordinator(s) :

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Place : *multi-site project Laplace (Toulouse) – Nexans (Lyon)*

The Phd is hosted at Laplace Laboratory in Toulouse. However, long stays in Nexans Lyon are planned, for experimental purposes and also to understand the industrial issues of the project.

Expected profile :

Candidate having a Master degree in the domain of Electrical Engineering or Material Sciences, with knowledge in dielectric physics. Skills in modelling (particularly using (Comsol MultiPhysics©) would be appreciated as well.

Financial support :

~1500 euros net per month

How to apply :

- Complete and detailed CV, contact details of at least two referents (scientific and educational) including email address and phone number, and covering letter.
- Please specify in the email object 'PhD Application –Laplace/Nexans'