MSc thesis
Humidity dependent surface charging in air for HVDC applications

**Background**
HVDC transmission is an efficient technology for transporting large amount of electrical power over long distances. For a reliable operation, a robust insulation system is needed. One key component in the insulation system is polymers and their interface with Air. Under DC stress the polymer surface will be charged resulting in local variations of the electrical field. Understanding of these phenomena are crucial input to an optimal and reliable design of HVDC insulation systems. In resent research it is found that the surface charging at air-polymer interfaces strongly depend on the air humidity. This phenomenon as so far not extensively studied, and the underlying mechanisms are not well understood.

The target of the present MSc work is to systematically study the surface charge dynamics at polymer/air interfaces and how it depends on the humidity content in air at electrical field well below the onset for corona. The starting point will be an existing experimental set up build in an earlier MSc work. In this earlier work surface charging at various humidity was measured with 4 kV applied to a rod electrode with hemispherical tip with a radius of 4 mm placed 3 mm above a polymer surface.

**Work description:**
In this Msc work the surface charge dynamics at polymer/air interfaces and how it depends on the humidity content in air will be systematically studied for different variations of the geometry and voltage.

Tasks:
- Literature study of the topic.
- Reinstall existing experimental set-up, for measurement of surface charging under various humidity and voltage
  - Confirm earlier results
- Make improvement of the experimental set-up to handle geometrical variations
- Measure the surface charging at different conditions:
  - Systematic studies of various: Voltage, air gap distance, electrode radius and relative humidity
- Analyze and interpret the results
- Write a MSc thesis report

This MSc thesis work will be done at Chalmers and is part of collaboration between Chalmers and Hitachi Energy Research (HER). The starting time is January 2023 or earlier. A remuneration from HER will be paid at completion of the work. A part of the work could be done at HER in Västerås, as an option. For information contact: Adj. Prof. O. Hjortstam (HER/Chalmers), olof.hjorstam@hitachienergy.com or Prof. Y. Serdyuk (Chalmers), yuriy.sedyuk@chalmers.se

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1 D. Svensson, Chalmers Open Digital Repository: Humidity Dependence of Charge Accumulation on Polymer-Air Interfaces for HVDC Applications