Contribution ID: **35** Type: **Poster Presentation**

Study of Accelerating Surface Charge Dissipation on Epoxy Treated by Dielectric Barrier Discharge

Friday, 8 July 2016 14:40 (20 minutes)

Epoxy is used in the manufacture and electricity industry for a wide range of applications. However, it will easily form three-pronged and accumulate a lot of charge on the epoxy surface under high field strength. In this paper, dielectric barrier discharge (DBD) with a plate-in-parallel configuration was used to generate non-thermal plasmas for the surface modification of epoxy. The distribution of surface potential is measured by a Kelvin electrostatic probe which is connected to an electrostatic voltmeter. The water contact angle (WCA) and surface roughness are measured by contact angle measurement and atomic force microscopy, respectively. In addition, measurement of surface resistance is conducted before and after the plasma treatment. The experimental results show that surface potential decay on the treated material is much faster than that on the untreated ones. Moreover, the process is sensitive to relative humidity (RH) of ambient air. It can be observed that the decay rate increase with the increase of RH within the tested range. AFM shows that surface morphology is changed by plasma treatment, which causes the enhancement of surface roughness. The WCA shows that the treated surface is completely hydrophilic when the treating time reaches 60 s. Furthermore, surface conductivity for treated samples increase by one or two orders of magnitude compared to that for untreated samples. Such behavior is attributed to the increase amount of water absorbed and thus leading to stronger leakage of charge on the sample surface. The results can provide a reference for surface modification of epoxy in industrial applications.

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Session Classification: Poster 3-A

Track Classification: Plasmas, Discharges, and Electromagnetic Phenomena