Triboelectrification of insulators in low humidity environments

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***Abstract* — Triboelectric charging is a natural phenomenon, evident in a wide range of occurrences including volcanic lightning and grain silo explosions, that can adversely affect manufacturing processes. Electrical charge is transferred when two material surfaces contact and separate from each other. Currently, the mechanisms and variables that affect triboelectrification are poorly understood. Three mechanisms: electron, ion, and mass transfer, are believed to be responsible for the charge transfer. Variables such as relative humidity and material selection contribute to the sign and magnitude of charging that transpires. To investigate these variables and the mechanisms responsible, particles (300-800 μm) were gravitationally driven through a spiraled insulator tube (ID 1.5 mm). The tube was held in a controlled chamber with adjustable humidity and pressure. The rate of charge accumulation was recorded as the particles traversed through the copper Faraday tube. The charged particles were collected in a Faraday cup, and the total accumulated charge on each particle was calculated. Two types of particles (soda lime glass, polystyrene) and tubing (Nylon, Teflon) were studied due to their inherently different hydrophilicities and partial charges. This procedure was performed at various humidities to isolate the role of relative humidity. The study aims to determine the effects that humidity and material selection have on triboelectrification as well as to gain a better understanding of the mechanisms responsible for triboelectric charging of insulators.**