Abstract Submitted
for the 4CF17 Meeting of
The American Physical Society

Temperature Dependence of Electrostatic Discharge in Highly Disordered Polymers[1] TYLER KIPPEN, ALLEN ANDERSEN, JR DENNISON, Utah State Univ — The study of electrostatic discharge (ESD) has direct applications to spacecraft charging, along with many high voltage DC power applications, making it critical to understand how ESD varies due to changing environmental conditions, including temperature. Standard step-up to electrostatic discharge tests were performed on several polymers, including low density polyethylene (LDPE), polyetheretherketone (PEEK), and Kapton at temperatures ranging from 260 K to 360 K. Preliminary analysis suggests that temperature affects the breakdown field strength, but that the effects are strongly material dependent. These results are compared to a proposed atomic scale model of how defect sites trap charge carriers, leading to charge build up and eventual breakdown. Our dual-defect theory for ESD incorporates both lower energy recoverable defect modes that can be generated and annihilated through thermal annealing and higher energy irrecoverable defect modes such as those created by radiation damage. The model suggests that at lower electric field strengths, an annealing process occurs due to higher temperatures which limits the density of low energy defects in the material.

[1]This work was supported by a NASA Space Technology Research Fellowship.

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Date submitted: 20 Sep 2017 Electronic form version 1.4