10-12-2018

Effects of Radiation on the Electrostatic Discharge of Polymers

Kip Quilter
Utah State University

Megan Loveland
Utah State University

Alexandra Hughlett
Utah State University

JR Dennison
Utah State Univesity

Fall 2018 Four Corner Section Meeting of the
American Physical Society

University of Utah
Salt Lake City, UT
October 12-13, 2018

Effects of Radiation on the Electrostatic Discharge of Polymers

Kip Quilter, Megan Loveland, Alexandra Hughlett, and JR Dennison

Materials Physics Group, Physics Department, Utah State University

Abstract

Measurements have been made to determine if an increased density of localized defects generated by ionizing radiation affects the electrostatic breakdown of highly disordered insulating materials. Five highly disordered polymeric materials were chosen (Polyether ether ketone, Kapton, Fluorinated ethylene propylene, Polypropylene, Low-density polyethylene) for their different tolerance to radiation. These polymers were exposed to 5kGy of penetrating beta radiation *in vacuo* to change the density of the localized defect states throughout polymer. Increasing density of localized states were known to enhance the hopping conductivity of polymers. Electrostatic discharge (ESD) field, strongly viewed as an extreme limit of conductivity, is therefore expected to be decreased by radiation induced defects. The breakdown of the polymers is measured under vacuum in a parallel plate geometry. In a standard ramp up test, the voltage is increased until a large jump in the current is observed. Measurements were made on unirradiated, irradiated, and irradiated samples that had been exposed to moist air for an extended time to determine the effects of radiation on ESD and if a sample is able to recover from radiation by being exposed to oxygen and water from the atmosphere.

Kip Quilter, Megan Loveland, Alexandra Nelson, and JR Dennison "*Effects of Radiation on the Electrostatic Discharge of Polymers*," *American Physical Society Four Corners Meetin*g, University of Utah, Salt Lake City, UT, October 12-13, 2018.