

Abstract Submitted
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Embedded Charge Distributions in Electron Irradiated Polymers – Pulsed Electroacoustic Method Reproducibility and Calibration

ZACHARY GIBSON, JR DENNISON, Material Physics Group, Physics Department, Utah State University, Logan, UT, RYAN HOFFMANN, Air Force Research Lab, Space Vehicles Directorate, Albuquerque, NM — The pulsed electroacoustic (PEA) method has been used to measure the embedded charge distributions in electron irradiated polymers. The PEA method allows for non-destructive direct measurements of embedded charge distributions in dielectric materials. Samples of polyether-etherketone (PEEK) and polytetrafluoroethylene (PTFE) of 125 μm or 250 μm thickness were tested after irradiation with either a 50 keV or 80 keV electron beam. The reproducibility of the PEA method and the experimental conditions were studied by: (i) measuring each sample multiple times in a given mounting configuration, (ii) re-measuring each sample after repositioning them in the PEA test fixture, and (iii) measuring two similar samples of each of these eight different experimental configurations. For accurate absolute measurements of the charge distribution and deposition depths, calibration of charge position, charge density, and amplitude attenuation for the PEA system are required. Calibration is accomplished by measuring the speed of sound in each material and by observing the effects of applying a small DC voltage to use as a reference signal. A deconvolution of the measured waveform is performed with the reference signal to remove the effects of system response, resulting in only the charge distribution. Reproducibility of measurements before and after application of DC voltage identified any effects of the applied voltage.

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