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Beta Radiation Damage Thresholds and Failure Rates of Micro-SD Cards[1] ACHAL DUHOON, JORDAN LEE, JR DENNISON, Utah State University, MATERIALS PHYSICS GROUP TEAM — Radiation effects in microelectronics are a serious concern for their performance and survivability in radiation environments and are divided into 3 categories. Total Ionizing Dose (TID) effects typically result from homogeneous accumulation of ionizing dose from electrons (e^-) or protons (p^+) over a long time in insulators. Displacement Damage effects typically result from the accumulation of non-ionizing dose from p^+ or high energy e^-, leading to generation of lattice defects. Single Event Effects typically result from localized, high ionizing doses from a single particle (p^+ or heavy ions) in a sensitive region of the devices. β tests done here focus on the TID effects. Radiation exposure tests on variety of micro-SD cards were conducted in the Utah State University's Space Survivability Test chamber, using a ˜90 mCi ^{90}Sr source emitting 0.2 to 2.5 MeV β radiation. The unbiased tests evaluated formatting and read/write speeds at a dose rate of ˜2.5 Gy/hr for 9 radiation intervals up to ˜1000 Gy TID. Micro-SD cards were tolerant up to 400 Gy TID, with almost all failures recovering in $\leq$4 hr. At higher TID >400 Gy, more failures and less recovery were observed. At the highest TID exposure of 1000 Gy, ˜25% of the cards failed altogether with no recovery. The next round of testing will include biased tests, where SD cards will be powered and the current spikes due to transient failures will be monitored.

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