X-ray irradiation induced carrier lifetime changes in stabilized amorphous selenium photoconductors

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Experiments were conducted to examine the effects of x-ray irradiation on the electron and hole lifetimes in stabilized amorphous selenium (a-Se) Interrupted-Field Time-of-Flight (IFTOF) and conventional TOF measurements were performed on pure and stabilized a-Se films (stabilized means a-Se alloyed with 0.3%As and doped with a few ppm Cl) immediately after X-ray irradiation. Two different X-ray irradiation rates were used to elucidate the effect of x–ray dose rate on the electron lifetime reduction. These two exposure rates, 0.856 R/s and 0.571 R/s, that were used by controlling the X-ray tube filament current. The experiments were conducted for both electrons and holes at different amounts of accumulated dose in the sample. The experiment shows that, at room temperature, both electrons and holes behave similarly. The reduction in the lifetime with accumulated dose appears to be very roughly exponential. Further analysis shows that the parameters describing the decay of the lifetime with accumulated dose are different for holes and electrons. The dose rate difference does not result in a significant difference in the lifetime vs. accumulated dose behavior for both electrons and holes. This shows the generation of X-ray induced deep traps does not depend on the dose rate but rather on the total dose delivered.