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Student Paper

Injection and Temperature Dependent Carrier Lifetime in Mercury Cadmium Telluride

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Minority carrier lifetime in mercury cadmium telluride ($Hg_{1-x}Cd_xTe$; MCT) should be maximized in order to minimize dark currents and maximize detectivity in MCT infrared (IR) detectors. Photoconductive decay (PCD) is a useful characterization technique for studying electrically active defects and measuring minority carrier lifetimes in MCT [1], whereby a pulse of excess charge carriers is injected into the material by a light source, the excess carriers undergo recombination to re-establish equilibrium levels, and the average recombination rate of excess carriers is measured. Temperature dependent PCD can reveal the energy level of Shockley-Read-Hall (SRH) recombination centers within the band gap; these centers lower the effective lifetime in MCT. Injection dependent PCD is performed by varying the photon flux during the experiment, resulting in varying levels of charge carrier injection. In conjunction with temperature dependent studies, the injection dependent lifetime can reveal the energy level of the SRH centers, as well as the density/capture cross-section product of the SRH centers [2]. Measurement and analysis of carrier lifetimes in MCT is presented, along with measured SRH level and density/capture cross-section product.

References

[1] V. C. Lopes et al., "Minority carrier lifetime in mercury I cadmium telluride," *Semicond. Sci. Technol.*, vol. 8, pp.824-841, 1993

[2] S. Rein et al., "Lifetime spectroscopy for defect characterization: Systematic analysis of the possibilities and restrictions," *J. Appl. Phys.*, vol. 91, no. 4, pp.2059-2070, February 2002