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Temperature Dependence of Polysilicon Photodetectors for Integrated Optical Sensors and Electronics Applications ROBERT POWNALL, Colorado State University, GUANGWEI YUAN, KEVIN L. LEAR — While single-crystal silicon photosensors are frequently integrated with CMOS electronics, polycrystalline silicon photodetectors allow more flexibility in processing. Integrated polysilicon detectors have promise in areas as diverse as biological sensors and optical interconnects for electronic circuits. Temperature dependence studies reveal information about the photoconduction process in polysilicon, including the function of traps or carrier reinjection/generation at the contacts in addition to the known variation of the absorption coefficient. Measurement of the photoresponse of metal-semiconductor-metal polysilicon photodiodes incorporated in a commercial CMOS process produced activation energies of 0.35eV and 0.54eV for photocurrent and dark current, respectively, indicating an acceptable contrast penalty for many applications. The mobility-lifetime product is estimated by fitting DC photoresponse versus electrode spacing, and the results compared to AC measurements to derive additional insight into the underlying physical processes.

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