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Study of band-edge optical absorption of silicon nanoparticles using photothermal deflection spectroscopy[1] SAN THEINGI, CHITO KENDRICK, TIANYUAN GUAN, LAUREN VITTI, GRANT KLAFEHN, LUIGI BAGOLINI, MARK LUSK, BRIAN GORMAN, Colorado School of Mines, PAUL STRADINS, National Renewable Energy Laboratory, CRAIG TAYLOR, REUBEN COLLINS, Colorado School of Mines — Silicon nanoparticles (SiNPs) are a promising optoelectronic material with unique properties such as a size tunable bandgap, sensitivity to surface termination, and efficient optical emission. Here, we present an optical absorption study of size varied, free standing SiNPs films using photothermal deflection spectroscopy (PDS). In general, it is difficult to directly observe the absorption threshold in SiNPs because of silicon's low absorption coefficient. PDS, which directly measures the optical absorption of materials through the generated heat, is known for its extremely high sensitivity. The SiNPs are grown using a plasma process and deposited as films on quartz substrates. Different amounts of SF_6 gas are introduced into the process gas to control the size of these SiNPs. Photoluminescence measurements show a strong blue shift in emission with increased SF_6 flow. PDS measurements allow a corresponding blue shift in the band edge absorption which is attributable to quantum confinement to be observed. In addition, PDS measurements also allow us to probe the defect level of our material, and the size distribution of SiNPs in our sample.

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