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Measuring Charge Transport in a Semiconductor Thin Film Using an Integrated Electrometer KENNETH MACLEAN, TAMAR MENTZEL, MARC KASTNER, MIT — Measurements are presented of charge transport in an amorphous hydrogenated silicon (a-Si:H) thin film obtained using a nanometer scale metal-oxide-silicon field effect transistor (MOSFET) as an electrometer. At low temperatures, we are able to measure extremely high resistances ($\sim 10^{17}$ Ω) for the a-Si:H using a time resolved charge sensing technique. At higher temperatures, where the a-Si:H resistance is not too large, the resistance obtained from the charge sensing measurement agrees with the result obtained from a traditional current versus voltage measurement. We show how the integrated electrometer can be used to probe the electronic structure, including measuring the density of localized states at the Fermi level, of thin films that are too resistive to be investigated with traditional transport techniques. This work has been supported by the US Army Research Office (W911NF-07-D-0004) and the Department of Energy (DE-FG02-08ER46515).

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