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Thin film thermocouples for thermoelectric characterization of nanostructured materials MATTHEW GRAYSON, CHUANLE ZHOU, ANDREW VARRENTI, SEUNG HYE CHYUNG, JIEYI LONG, SEDA MEMIK, Electrical Eng. Comp. Sci, Northwestern University — The increased use of nanostructured materials as thermoelectrics requires reliable and accurate characterization of the anisotropic thermal coefficients of small structures, such as superlattices and quantum wire networks. Thin evaporated metal films can be used to create thermocouples with a very small thermal mass and low thermal conductivity, in order to measure thermal gradients on nanostructures and thereby measure the thermal conductivity and the Seebeck coefficient of the nanostructure. In this work we confirm the known result that thin metal films have lower Seebeck coefficients than bulk metals, and we also calibrate the Seebeck coefficient of a thin-film Ni/Cr thermocouple with 50 nm thickness, showing it to have about 1/4 the bulk value. We demonstrate reproducibility of this thin-filmSeebeck coefficient on multiple substrates, and we show that this coefficient does, in fact, change as a function of film thickness. We will discuss prototype measurement designs and preliminary work as to how these thin films can be used to study both Seebeck coefficients and thermal conductivities of superlattices in various geometries. The same technology can in principle be used on integrated circuits for thermal mapping, under the name "Integrated On-Chip Thermocouple Array" (IOTA).

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