Abstract Submitted
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Enhanced Thermoelectric Performance in Rough Silicon Nanowires[1] RENKUN CHEN, Dept. of Mech. Engr., UC Berkeley, ALLON I. HOCHBAUM, RAUL DIAZ DELGADO, WENJIE LIANG, ERIK C. GARNETT, Dept. of Chemistry, UC Berkeley, MARK NAJARIAN, Dept. of Materials Sci. & Engr., UC Berkeley, ARUN MAJUMDAR, Dept. of Mech. Engr., UC Berkeley, PEIDONG YANG, Dept. of Chemistry, UC Berkeley — Due to the disparity between electron (<10 nm) and phonon (~100 nm) mean free paths in silicon, nanostructured Si could effectively block phonon transport by boundary scattering while maintaining electron transport, thereby enhancing thermoelectric figure of merit, ZT. Here we report the wafer-scale electrochemical synthesis and thermoelectric characterization of rough Si nanowires with enhanced ZT, relative to the bulk material. Single nanowire measurements show that their electrical resistivity and Seebeck coefficient are similar to those of bulk Si with similar dopant concentration. Thin nanowires, however, exhibit a 100-fold reduction in thermal conductivity (k), yielding a large ZT = 0.6 at room temperature. Although bulk Si is a poor thermoelectric material, Si nanowire arrays show promise as high-performance, scalable thermoelectric materials.

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