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Thermoelectric Properties of Semiconducting Silicide Nanowires
SONG JIN, JEANNINE SCZECH, JEREMY HIGGINS, University of Wisconsin-Madison, FENG ZHOU, LI SHI, University of Texas-Austin — Semiconducting silicides are promising thermoelectric materials. In addition to their respectable thermoelectric figure-of-merit (ZT up to 0.8), silicides have the advantages of low cost, excellent thermal stability and mechanical strength, and outstanding oxidation resistance, making them suitable for high temperature applications. We have developed general synthetic approaches to single crystal nanowires of silicides to investigate the enhancement of thermoelectric properties due to the reduced nanoscale dimension and to explore their applications in thermoelectrics. We will discuss the synthesis and structural characterization of nanowires of chromium disilicide ($CrSi_2$) prepared via a chemical vapor transport (CVT) method and chemical vapor deposition (CVD) of organometallic precursors to synthesize the Novontony Chimney ladder phase $MnSi_{1.75}$. The Seebeck coefficient, electrical conductivity, and thermal conductivity of individual $CrSi_2$ nanowires were characterized using a suspended microdevice and correlated with the structural information obtained by microscopy on the same nanowires. This combined Seebeck coefficient and electrical conductivity measurements also provide an effective approach to probing the Fermi level, carrier concentration and mobility in nanowires. We will also discuss our progress in using individual nanostructures combined well-defined structural characterization to conclusively investigate the complex thermoelectric behaviors of silicide materials.

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