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Hysteretic melting and freezing of nanoscale indium islands using local thermal cycling for phase-change memory nodes TODD BRINTLINGER, Dept. of Materials Sci. and Eng., Univ. of Maryland, KAMAL HUSSAIN BALOCH, Dept. of Chemical Physics, Univ. of Maryland, YI QI, Dept. of Materials Sci. and Eng., Univ. of Maryland, WILLIAM G. CULLEN, MRSEC, Univ. of Maryland, College Park, DAVID GOLDHABER-GORDON, Dept. of Physics, Stanford University, JOHN CUMINGS, Dept. of Materials Science and Eng., Univ. of Maryland, College Park — Using a transmission electron microscope (TEM) operating in dark-field mode, the melting and freezing transition in nanoscale (approximately 20-200nm diameter) metal islands can be imaged at video rates (33ms/frame). The metal, typically indium, islands are thermally evaporated on one side of a 100nm thick SiN membrane. Local thermal gradients produced by Joule heating of lithographically defined electrodes on the opposite side of the membrane show a hysteretic effect in the melting/freezing of the metal islands. Read and write cycles are accomplished with 5-10 microW power, while a quiescent power of 80-100 microW is required to keep an island near its melting point. The hysteresis indicates a finite nucleation energy during freezing of individual islands. While TEM is not a practical readout mechanism, the behavior suggests a type of phase-change memory node on an inherently nanometer scale. Results for all the aforementioned will be shown, including micrographs, video, and related discussion.

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