Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Charge injection, transport and trapping in nanoparticle based memory devices J. CAMPBELL SCOTT, LUISA BOZANO, IBM Almaden Research Center, RYAN CHIECHI, Chemistry Dept., UCLA, JODI IWATA, San Jose State Univ. — Blends of metallic nanoparticles in a semiconducting organic host show bistable electrical resistance at low (∼1 V) reading voltage. When a layer of the blend, of order 100 nm thick, is sandwiched between electrodes, a low resistance (on) state is set by applying a voltage pulse of order 2 V to 3 V, and is switched to the high resistance (off) state by a pulse of about 6 V to 8 V. This behavior is observed for several different metals (e.g. Au, Ag, Al, Mg) and for both polymeric and small-molecule semiconductors. We interpret the switching and bistability in terms of charge trapping and storage on the nanoparticles. When trapped charge density is high, the resulting space-charge field inhibits charge injection, yielding the off-state, and vice versa. A simple model based on Fowler-Nordheim tunneling shows that particles of order 2 - 5 nm in diameter exhibit sharp discharge thresholds in the range of a few volts, as observed in the experiments.

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Date submitted: 01 Dec 2004 Electronic form version 1.4