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Resistive Switching in Metal-Nanowire/Polymer Nano-Gap Devices ROSE M. MUTISO, Department of Materials Science and Engineering, University of Pennsylvania, JAMES K. KIKKAWA, Department of Physics and Astronomy, University of Pennsylvania, KAREN I. WINEY, Department of Materials Science and Engineering, University of Pennsylvania — We recently presented the first examples of reversible resistive switching in bulk, glassy polymer nanocomposites. At compositions near the percolation threshold, Ag nanowire-polystyrene composites exhibit reversible resistive switching upon increase voltage at room temperature. We proposed that switching in these materials is the result of the field-induced formation of Ag filaments that bridge adjacent nanowire clusters, extending the percolation network and decreasing the sample's bulk resistivity. To further understand the switching mechanism and explore possible applications, we have designed and fabricated single-gap nanowire devices comprised of lithographically-defined metal lines separated by polymer-filled nano-gaps. We have successfully demonstrated reversible resistive switching in our nano-gap Ag/PS devices when the gap size is 20 - 100nm, observing highly reversible switching behaviors in some samples with high on/off ratios for over 50 cycles. Preliminary ex-situ high resolution imaging of the devices shows significant gap remodeling after a switching event, implying that the switching mechanism is linked to some form of electromigration of Ag electrodes. Additional ex- and in-situ characterization studies to elucidate observed trends are in progress.

Rose M. Mutiso
Department of Materials Science and Engineering,
University of Pennsylvania

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