Focused ion beam induced electrical conductance in a polymer

Kravchenko I., Gosh S., Lavrik N., Randolph S.

Center for Nanophase Materials Sciences, Oak Ridge National Laboratory

Exposure of polymers to heavy ions with kV energies leads to their conversion into carbon based nanomaterials and films, which can enable direct-write lithography methods. Here we explore effects of gold ion implantation onto thin polymer films to enable carbonization, which is verified by *in situ* measurement of emergent electrical conductivity during irradiation in a focused ion beam lithography chamber. The electrical conductance of the ion irradiated area initially grows with the ion irradiation dose to reach a saturation level. I-V curves do not display hysteresis and appear ohmic in character. Possible conductance mechanisms are discussed as well as the structural and chemical transformations giving rise to the phenomenon. An ion irradiation induced carbon layer was subsequently used as a mask for plasma etch of nanoscale patterns on a silicon surface with an excellent etch selectivity ratio demonstrating its applicability to lithographic patterning