Abstract Submitted
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Low-temperature transport in Ga-implanted wires in Si[1] S.J. ROBINSON, J.R. TUCKER, University of Illinois at Urbana-Champaign, T. SCHENKEL, Lawrence Berkeley National Laboratory, T.-C. SHEN, Utah State University — Focused ion beams (FIBs) have potential applications in maskless device fabrication. Specifically, the narrow beam diameter and large scan range allow for the possibility of creating nanoscale interconnects (which must be highly conductive and ohmic) or even quantum devices. Here we report a low-temperature ($<$ 20 K) transport study of Ga wires created by both conventional implantation and a commercial FIB system. We find that the FIB wires yield nonlinear sheet resistances that are much higher than those of the conventional wires, which remain metallic and ohmic below 1 K. In addition, although both types of wires have positive magnetoresistance, the FIB wires show a much greater magnetic effect. The apparent conduction mechanism in our FIB wires is variable-range hopping, which transitions into Efros–Shklovskii transport and yields a Coulomb gap in I–V measurements as the temperature is lowered. The effects of dose and annealing in conductivity will be discussed in the context of lattice defects, Ga clustering, and solid solubility.

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S. J. Robinson
University of Illinois at Urbana-Champaign

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