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Superconducting Proximity Effect in Thin Semiconducting Films
MICHAEL VISSERS, SOREN FLEXNER, PAUL WELANDER, KEVIN INDERHEES, TIM MCARDLE, JIM ECKSTEIN, University of Illinois at Urbana Champaign — We report results using a novel 3 terminal device structure that provides two independent resistance measurements that we use to examine the influence of the superconducting proximity effect on both the transport properties of the thin film N layer by quantifying its sheet resistance, Rs, as well as independently measuring the junction conductance across the N-S boundary, Gc. When the N layer is a degenerate semiconductor the changes in these quantities are large. Gc increases much more than the factor of 2 that Andreev Reflection or BTK theory predicts, and both Gc and Rs exhibit reentrance as temperature decreases. We interpret these effects as being due to a transition between a phase fluctuating and phase stiff proximity effect in the N layer. This manifests itself by moving the N-S electrical boundary into the semiconductor, increasing Gc, while simultaneously removing volume available to normal transport forcing the measured Rs to increase. This work was supported by the DOE BES at the F. Seitz Materials Research Laboratory at the University of Illinois, Urbana.

Michael Vissers

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