

Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Superconducting Proximity Effect in Thin Semiconducting Films

MICHAEL VISSERS, KEVIN INDERHEES, TIM MCARDLE, STEPHANIE LAW, PAUL GOLDBART, LAURA GREENE, JIM ECKSTEIN, University of Illinois at Urbana Champaign — We report results using a novel 3 terminal device to study the influence of the superconducting proximity effect on the sheet resistance of the N-layer, R_s , as well as the junction conductance across the N-S boundary, G_c . When the N-layer is a degenerate semiconductor the changes in these quantities are large. In samples with large G_c , we find that the N-layer sheet resistance below the SC transition increases as T decreases. We can also extract the actual J-E relationship by modeling the spatial current profile beneath the injector electrode. We interpret these effects as being due to a phase stiff proximity effect in the N layer moving the N-S electrical boundary into the semiconductor as the temperature is lowered, thereby removing volume available to normal transport, and causing the measured R_s to increase. This work was supported by the DOE BES at the F. Seitz Materials Research Laboratory at the University of Illinois, Urbana.

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Date submitted: 21 Nov 2008

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