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Superfluid density in the ferromagnetic layers of superconductor-ferromagnet hybrid structures THOMAS LEMBERGER, MICHAEL HINTON, ADAM HAUSER, JULIAN HETEL, FENGYUAN YANG, JULIA MEYER, The Ohio State University — We have measured the areal superfluid density of superconductor-ferromagnet bilayers and trilayers. Samples are made by sputtering Nb and Ni films sequentially in an ultrahigh vacuum chamber with base pressure $<10^{-9}$ torr. Interfaces are cleaner when Ni is sputtered onto Nb for reasons related to disorder at the initial growth of Nb films. Superfluid density is measured using a low-frequency (50 kHz) two-coil technique with coils on opposite sides of the sample. These measurements provide the true T_C, i.e., the temperature below which superfluid exists. We find a nonmonotonic dependence of T_C on ferromagnetic layer thickness, in agreement with resistive measurements of T_C. The superfluid density is also nonmonotonic. Even at large ferromagnetic layer thicknesses where T_C is essentially constant, the areal superfluid density continues to increase, indicating that superfluid extends deeply into the ferromagnet layers. We will discuss these measurements in the context of theory of the superconductor-ferromagnet proximity effect.

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