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Ferromagnetic Stability in Fe Nanodot Assemblies on Cu(111) Induced by Indirect Coupling through the Substrate MARIA A. TORIJA, Oak Ridge National Laboratory, University of Tennessee, Knoxville, J.P. PIERCE, Oak Ridge National Laboratories, Sandia National Laboratories, Z. GAI, Oak Ridge National Laboratory, Peking University , China, E.W. PLUMMER, J. SHEN, Oak Ridge National Laboratory, University of Tennessee, Knoxville — To first order, assemblies of nano-scale magnetic dots are superparamagnetic. In these systems, thermal energy, which causes fluctuation of the dots' magnetic moments, becomes significant enough to overcome the anisotropy energy barrier and randomize their orientation at the blocking temperature. This typically occurs far bellow room temperature. We report collective ferromagnetic behavior in two- dimensional Fe dot assemblies on the Cu(111) surface that persists above room temperature. Our ability to tune the average size and spacing of the dots enables us to investigate the relative contributions of the mechanisms that support this unexpectedly robust magnetic order. Our experimental results and simulations indicate that the high-Tc ferromagnetism cannot be explained by either magnetic anisotropy or dipolar interaction. Direct comparison of the Curie temperatures (Tc) of similar dots prepared on various substrates including Cu(100) and Ge(111) allows us to conclude that the observed high-Tc ferromagnetism for Fe dots on Cu(111) is a result of an indirect exchange interaction via the surface states of Cu(111) substrate.

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