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Stabilization of surface magnetism by organic-acid adsorption[1] J. GÁZQUEZ, Instituto de Ciencia de Materiales Barcelona, Spain, J. SALAFRANCA, Universidad Complutense de Madrid, Spain, N. PÉREZ, A. LABARTA, Universitat de Barcelona, Spain, S.T. PANTELIDES, Vanderbilt University, TN, S.J. PENNYCOOK, Oak Ridge National Laboratory, TN, X. BATLLE, Universitat de Barcelona, Spain, M. VARELA, Oak Ridge National Laboratory, TN
— Magnetically-disordered layers at the surface of nanoparticles and low dimensionality magnetic oxides significantly reduce the magnetization density with respect to bulk values. However, high crystal quality Fe_3O_4 nanoparticles capped with non-magnetic organic acid molecules display a surprisingly high magnetization, of unknown origin. Here, we present a real space structural, chemical and magnetic characterization of oleic-acid-caped Fe_3O_4 nanoparticles with nanometer resolution, demonstrating the presence of a strong magnetic surface layer. In combination with theoretical calculations, we establish the key role of the nanoparticle/organic-acid bond. Magnetization is restored in the surface layer because the bonding with the acid's O atoms partially lifts the surface reconstruction, resulting in surface O-Fe atomic configuration and distances close to the bulk values. Our findings have implications for the optimization of magnetic properties of nanoparticles and thin films.

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Jorge Salafranca
Universidad Complutense de Madrid

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