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Magnetism of Undoped and Co-Doped TiO2 Clusters X. WEI, R. SKOMSKI, M. SCHUBERT, D. SELLMYER, Nebraska Center for Materials and Nanoscience, University of Nebraska — TiO_2 is a widely used optically active material, and transition-metal doped TiO_2 has attracted much attention in spin electronics. Recently, it has been argued that ferromagnetism is a universal feature of nanoparticles of nonmagnetic oxides, and our focus is on doped and undoped TiO_2 nanoclusters. The clusters are examined with TEM, AFM, MFM, and hysteresis loops and zero field cooled magnetization curves were measured by SQUID magnetometry. Both doped and undoped films display hysteresis and magnetic order in the investigated temperature range of 5K to 400 K. The ordering temperature is above 400 K, and both magnetization and coercivity are enhanced in the out-of-plane direction. Undoped TiO_2 particles exhibit a nominal moment of about 0.2 μ_B per surface atom. Small Co concentrations have little effect on the magnetism of the particles. Higher Co doping percentages, about 8%, yield proteretic (clockwise) loops, indicating the formation of CoO. It has been suggested that the magnetic moment of 'nonmagnetic' oxide thin films is a surface effect, and the comparison of different particle sizes yields a similar picture for our particles. Our renormalization-group modeling assumes indirect exchange interactions between scarce magnetic moments and yields a logarithmic dependence of the ordering temperature on the particle size
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