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Development of ferromagnetism in Pd nanoparticles with reduction in size MOHINDAR SEEHRA, JAMES RALL, West Virginia University, J. LIU, C. ROBERTS, Auburn University — Bulk fcc Pd is a paramagnet just missing the Stoner criterion for ferromagnetism ($N(E_F)I > 1$) [1]. Several groups have reported weak ferromagnetism in 2-4 nm Pd nanoparticles (NPs) [2]. We report systematic development of weak ferromagnetism in Pd NPs with reduction in size. Magnetic measurements (M vs. T) are compared for bulk Pd with those of size D $\approx$ 50nm, 7nm, and 6nm. The samples of size D = 7 nm and 6 nm were prepared by an aqueous seed-mediated growth and characterized by TEM and x-ray diffraction with the latter showing expansion of the lattice with decrease in size. Compared with the low-field magnetic susceptibility χ of bulk Pd, χ for the 7 and 6 nm NPs are enhanced by an order of magnitude. For the 50 nm NPs, χ follows nearly the Curie law. The hysteresis loops (M vs. H) for the 7 and 6 nm NPs shows a decrease in coercivity and remanence from 2K to 300K suggesting $T_C > 300$K. Origin of this ferromagnetism in terms of surface magnetism and lattice expansion is discussed. [1] W. Gerhardt et al, Phys. Rev. B 24, 6744 (1981); [2] T. Shinohara et al, Phys. Rev. B 91, 197201 (2003); Jeon et al, J. Appl. Phys. 103, 09413 (2008); Litran et al, Phys. Rev. B 73, 054404 (2006).

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