Magnetization and Resistivity Study of FCC $\gamma$-Fe Precipitates in Cu

JOSEPH BUDNICK, WILLIAM HINES, ROBERT MILLER, DOUGLAS PEASE, DAVID PERRY, POORANI SHANTHAKUMAR, Department of Physics, University of Connecticut, Storrs, CT 06269-3046 — Magnetization and resistivity measurements on two samples of Cu + 2.0 at.% Fe are reported here. The first sample, prepared by annealing at 950 °C for 2 days followed by rapid quenching, consists of a random solid solution of Fe in Cu. The magnetization follows the Curie-Weiss law $10 \, K < T < 300 \, K$ yielding an effective Fe moment of $1.9 \, \mu_B \pm 0.1 \, \mu_B$ and Curie temperature of $-2.0 \, K \pm 2.0 \, K$. The second sample, prepared using the heat treatment above followed by a second annealing at 620 °C for 2 hours, consists of face-centered-cubic $\gamma$-Fe precipitates in the Cu matrix. Evidence is given for an antiferromagnetic ordering occurring in this sample with a Néel temperature $\approx 55 \, K$. The magnetization follows the Curie-Weiss law $100 \, K < T < 300 \, K$ yielding an effective Fe moment of $1.8 \, \mu_B \pm 0.2 \, \mu_B$ and a Curie temperature of $-58 \, K \pm 10 \, K$. Resistivity measurements are also presented which assist in describing the structural nature and relevant magnetic interactions for these two samples.

Changkun Xie
Department of Physics, University of Connecticut, Storrs, CT 06269-3046

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