Abstract Submitted
for the APR11 Meeting of
The American Physical Society

Raman Study of the Verwey Transition in Magnetite (Fe_3O_4) at High Pressure and Low Temperature: Effect of Aluminum Doping[1]
ZHANNA SHIRSHIKOVA, LEV GASPAROV, V. STRUZHKIN, A. GAVRILIUK, H. BERGER — Raman spectra of pure and doped magnetite provide a set of markers allowing one to study how the Verwey transition in magnetite changes with the change of pressure. At ambient pressure Verwey transition temperature, T_v, of the single crystals of magnetite, Fe_3O_4, is determined to be 123K. High-pressure experiment indicates strong dependence of the change of pressure vs. change in the Verwey transition temperatureon the amount of impurities: for pure Fe_3O_4 the change is -0.2 GPa/K; for doped iron, $Fe_{2.98}Al_{0.02}O_4$, the change is -0.09 GPa/K. Aluminum-doped magnetite ($Fe_{2.98}Al_{0.02}O_4$) where Al substitutes Fe^{+2} and Fe^{+3} atoms, represents a 2% aluminum doping, which shifts the Verwey transition temperature to T_v=118.5K. The rate with which the Verwey temperature decreases with pressure is further discussed based on the molar specific heat measurements.

[1]This work was supported by the NSF DMR-0805073 award, Alexander von Humboldt Foundation, Research Corporation Cottrell College Science award No. CC 6130, Petroleum Research Fund award No. 40926-GB10 and ONR N00014-06-1-0133 award.

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Date submitted: 13 Jan 2011 Electronic form version 1.4