Abstract for an Invited Paper
for the MAR06 Meeting of
The American Physical Society

Effects of the Spin Transition of Iron in Magnesiowüstite-(Mg,Fe)O: Applications to the Earth's Lower Mantle[1]

JUNG-FU LIN, Lawrence Livermore National Laboratory

Magnesiowüstite [(Mg,Fe)O] is the second most abundant mineral in the Earth's lower mantle. Here I will discuss the spin states of iron in magnesiowüstite and the isolated effects of the electronic transitions on the elastic, thermodynamic, magnetic, and vibrational properties of magnesiowüstite under high pressures and high temperatures. Pressure-induced electronic spin transitions of iron from high-spin to low-spin states have been recently observed to occur in magnesiowüstite under high pressures using high-pressure X-ray emission spectroscopy and synchrotron Mössbauer spectroscopy. Based on the synchrotron Mössbauer studies of $(Mg_{0.75},Fe_{0.25})O$, the simultaneous disappearance of the quadrupole splitting and the drop of the isomer shift at above 62 GPa are consistent with a high-spin to low-spin electronic transition of iron in the sample between 62 and 70 GPa. Addition of FeO in MgO stabilizes the high-spin state to higher pressures and the high-spin to low-spin transition of iron in magnesiowüstite results in an abnormal compressional behaviour between the high-spin and the low-spin states[1]. Moreover, there are also significant changes in particular physical properties of magnesiowüstite such as force constant across the electronic spin transition. Here I have combined results from a variety of high-pressure techniques to understand the effects of the electronic transition on the physical properties of magnesiowüstite and to explore possible geophysical consequences of the transition in the Earth's lower mantle. [1]J. F. Lin, V. V. Struzhkin, S. D. Jacobsen, M. Hu, P. Chow, J. Kung, H. Liu, H. K. Mao, and R. J. Hemley, Spin transition of iron in magnesiowüstite in Earth's lower mantle, *Nature,* 436, 377-380, 2005.

[1]This work was performed under the auspices of the U.S. DOE by UC and LLNL under Contract W-7405-Eng-48.