Thermal conductivity anomaly in siderite across iron spin transition

*趙 耕賢^{1,2}、黄 文正²、謝 文斌¹ *Keng-Hsien Chao^{1,2}, Wen-Jeng Owen Huang ², Wen-Pin Hsieh¹

1. 台湾中央研究院地球科学研究所、2. 台湾中央大学応用地質研究所

1. Institute of Earth Science, Academia Sinica, Taiwan, 2. Graduate Institue of Applied Geology, National Central University, Taiwan

Prior studies have shown that a pressure-induced iron spin transition in siderite occurs around 40°55 GPa and the spatial distribution of the spin states within the siderite may be inhomogeneous. Here we combined diamond anvil cell with the ultrafast optical pump-probe method and Raman spectroscopy, which enables characterization of the fraction of low-spin state, to investigate the lattice thermal conductivity of siderite across the spin transition. We found that during the spin transition the thermal conductivity varies significantly with the fraction of low-spin state: the conductivity increases rapidly with the increasing fraction of low-spin and then suddenly drops as the spin transition almost completes. Such spin-transition-induced thermal conductivity anomaly may result in local inhomogeneous heat flux and temperature profile in the lower mantle if the siderite can be transported to about 1100 to 1500 km depth. A preliminary discussion on the fundamental mechanism of the anomalous thermal conductivity through spin transition will be presented.

キーワード:菱鉄鉱、スピン転移、熱伝導率 Keywords: siderite, spin transition , thermal conductivity