

Study of liquid iron alloys at high temperature and high pressure by X-ray scattering using the double sided laser heated diamond anvil cell

In this study, we have done a in situ investigation of Fe-S and Fe-O phase diagrams in the solid and in the liquid state up to 135 GPa and and high temperatures (from 1500 K up to 3500 K).

Concerning the Fe-S system, we bracketed sulphur solubility in solid iron using in situ X-ray diffraction (Figure 1). The disappearance of Fe₃S diffraction peaks with increasing pressure help us to define if complete solubility was achieved (~7.5 %at S at 134 GPa). Therefore, the Fe-S phase diagram could be reconstructed under Earth's core conditions using data from previous experiments (Morard et al., 2008).

Concerning Fe-O phase diagram, no clear liquid signature has been detected even for temperature largely higher than previously determined eutectic temperature. Nanocrystalline Al₂O₃ and NaCl were used as pressure medium. For compound with high melting point, new pressure media need to be tested, such as monocrystalline alumina.

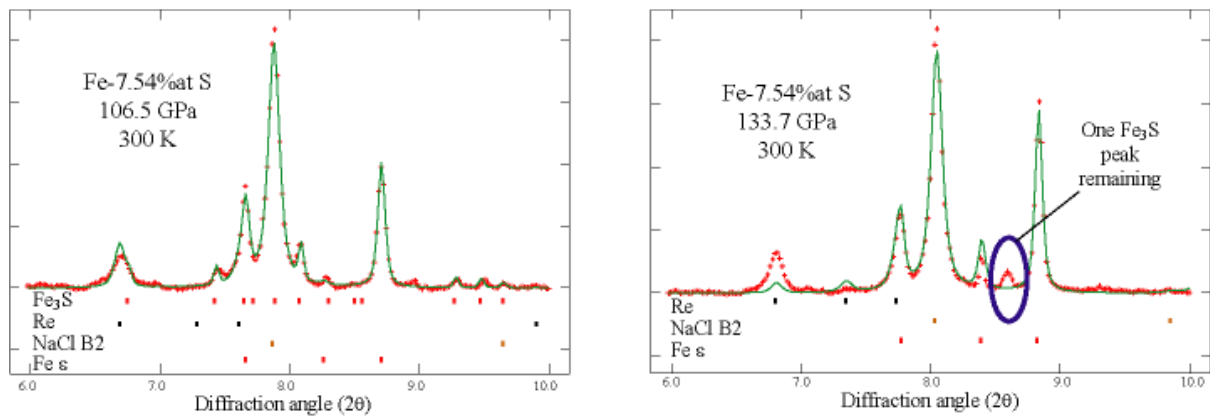


Figure 1 : Diffraction patterns of quenched product with initial composition of 7.54%at S at different pressures. Fe₃S phase has almost disappeared at 133.7 GPa, with only a weak single peak. It means that S is almost entirely entered in the Fe phase.

Morard, G., Andrault, D., Guignot, N., Sanloup, C., Mezouar, M., Petitgirard, S., and Fiquet, G., 2008. *In-situ* determination of Fe-Fe₃S phase diagram and liquid structural properties up to 65 GPa. *Earth Planet. Sc. Lett.* **272**, 620-626.