

Phase relations of an Fe-Ni alloy determined in an internally-heated diamond anvil cell

TETSUYA KOMABAYASHI¹, KEI HIROSE²
AND YASUO OHISHI³

¹Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro,
Tokyo 152-8551, (komabayashi.t.aa@m.titech.ac.jp)

²Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro,
Tokyo 152-8551, (kei@geo.titech.ac.jp)

³Japan Synchrotron Radiation Research Institute, 1-1-1 Kouto,
Sayo, Hyogo 679-5198, (ohishi@spring8.or.jp)

The Earth's core is believed to contain several amounts of nickel while its major component is iron. In order to understand the nature of the Earth's core, we conducted *in situ* X-ray diffraction study of an iron-nickel alloy in an internally-resistive heated diamond anvil cell (DAC) up to pressures (P) and temperatures (T) of 110 GPa and 2500 K. High-P-T experiments with the angle-dispersive X-ray diffraction system were conducted at the SPring-8. The improved internally heated DAC configuration provides stable heating with reliable temperature and pressure determination and phase identification [1]. Due to this configuration, we are able to put tight constraints on the P-T location and the width of the two phase loop of the γ (face-centered cubic structure) and ϵ (hexagonal close-packed structure) phase transition boundary.

Results show that γ and ϵ transition boundary in $\text{Fe}_{0.9}\text{Ni}_{0.1}$ is located at lower temperatures than that of pure iron, consistent with the previous works which used the laser-heated DAC [2, 3]. However, the width of the two-phase loop is narrower than those of previous works. We also evaluated the equation of state for the ϵ phase in $\text{Fe}_{0.9}\text{Ni}_{0.1}$ from the compression data to P = 100 GPa.

We will present the P-T phase diagram and the density of ϵ phase in $\text{Fe}_{0.9}\text{Ni}_{0.1}$, and discuss possible roles of the addition of nickel to iron in the Earth's core.

[1] Komabayashi *et al.* (2009) *EPSL* **282**, 252–257. [2] Lin *et al.* (2002) *GRL* **29**, 10.1029/2002GL015089. [3] Mao *et al.* (2006) *PEPI* **155**, 146–151.

Environmental geochemistry of Cu in agricultural soils treated with Cu-based fungicides

M. KOMÁREK* AND E. ČADKOVÁ

Czech University of Life Sciences Prague, Czech Republic

(*correspondence: komarek@af.czu.cz)

Introduction

Copper-based fungicides (such as the Bordeaux mixture - $\text{CuSO}_4 + \text{Ca}(\text{OH})_2$, Cu-oxychloride etc.) have been extensively used in Europe since the end of the 19th century to control fungal diseases on vine, such as downy mildew caused by *Plasmopara viticola*. Their long-term application and subsequent wash-off from the treated plants have resulted into extensive Cu accumulation in agricultural soils [1]. The aim of this paper is to provide information about the distribution, chemical fractionation and mobility of Cu in agricultural soils (vineyards, hop fields), including sorption processes and interactions with other commonly used organic fungicides (e.g. tebuconazole).

Results and Discussion

As in other contaminated soils, Cu in fungicide-impacted soils is mainly associated with the oxidizable and, to a lesser extent, with the reducible soil fraction, according to the soil organic matter and (hydr)oxide contents. The retention of Cu differs with the fungicide used (higher retention was observed for Cu originating from the Bordeaux mixture compared to Cu-oxychloride), which indicates that different retention processes occurs. The suggested mechanisms include: specific and non-specific adsorption (especially on soil organic matter) and precipitation of newly formed phases, such as CuO, $\text{Cu}(\text{OH})_2$, various Cu-hydroxysulfates etc. The retention of fungicide-derived Cu in the studied soil types can be well described by the Freundlich isotherm and is directly controlled by its chemical form [2]. The presence of other organic-based fungicides, e.g. tebuconazole, can alter the adsorption behavior of Cu due to speciation changes (e.g. formation of Cu-tebuconazole complexes) [3].

[1] Komárek *et al.* (2010) *Environ. Inter.* **36**, 138–151.

[2] Komárek *et al.* (2009) *J. Hazard. Mater.* **166**, 1395–1402.

[3] Jaklová Dytrová *et al.* (2011) *Rapid Commun. Mass Spectrom.* **25**, 1037–1042.