

MS15-P24 Diopside-titanian pargasite intergrowth: crystallography and formation mechanism. Serena C. Tarantino,^{a,b} Alberto Zanetti,^b Maurizio Mazzucchelli,^c Michele Zema,^{a,b} Florian Heidelbach,^d Nobuyoshi Miyajiima,^d Paolo Ghigna,^e Luca Olivi,^f Elisa Gasparini^a
^aDept. of Earth and Environmental Sciences, University of Pavia, Italy, ^bCNR-IGG, Pavia, Italy, ^cDept. of Earth Sciences, University of Modena and Reggio Emilia, Italy, ^dBayerisches Geoinstitut, University of Bayreuth, Germany, ^eDept. of Chemistry, University of Pavia, Italy, ^fElettra, Sincrotrone Trieste S.C.p.A., Italy
 E-mail: serenachiara.tarantino@unipv.it

The complicated multiphase arrangements displayed by most technological and geological materials on the one hand have dramatic effects on the physical properties of the material itself and, on the other hand, record its history. Aim of this work is reconstruct the mechanism of formation of a highly unusual tight alternation of diopside and titanian pargasite lamellae, observed in samples from spinel dunites belonging to the subcontinental mantle peridotite body of Balmuccia (Ivrea-Verbano Zone, Italy). These dunites show pockets related to melt infiltration characterised by early crystallisation of mm-long grains with such tight clinopyroxene-amphibole intergrowth. Amphibole crystallises lately as discrete phase, locally overgrowing the grains with amphibole-clinopyroxene intergrowth, being never in spatial continuity with the thin amphibole lamellae. A combined approach which makes use of long- and short-range crystallographic tools such as scanning and transmission electron microscopies, electron backscatter diffraction (EBSD), electron diffraction and X-ray Absorption Spectroscopy (XAS) has been used to characterize the two phases and their relative sizes and orientation. Microscopic inspections showed that in some grains, the thickness of the clinopyroxene lamellae (~20 µm) is around ten times that of amphibole, whereas in other cases the thicknesses of the two phases are comparable (2-5 µm). EBSD maps revealed an extremely ordered phase separation, in which amphibole lamellae, as well as the late crystals, are all parallel to (010) in the pyroxene, as expected on the basis of crystallographic considerations and in agreement with TEM observations. Diffraction contrast images showed the presence of finer (less than 100 nm) amphibole lamellae in the diopside, as well as the presence of semi-coherent interfaces giving rise to dislocations. Moreover, chain-width defects within the titanian pargasite have been revealed by HR-TEM images. TEM energy dispersive analyses revealed major element gradients across alternation of nm-scale lamellae, with diopside showing Al, Ti, Na and Fe increasing towards the contact with amphibole. Preliminary insights into the local structure of Ti⁴⁺, indicating a highly distorted octahedral coordination, have been obtained by means of XAS at the Ti-K edge performed on the same crystals.

On the basis of these observations, hypotheses on the origin of the tight alternation of diopside and titanian pargasite lamellae in such magmatic systems will be discussed.

Keywords: intergrowth structures; microstructure characterization; mineralogical crystallography

MS15-P25 Structure change and Peierls mechanism of metal-insulator transition in ferromagnetic K₂Cr₈O₁₆. Yutaka Ueda, Institute for Solid State Physics, University of Tokyo, Japan
 E-mail: yueda@issp.u-tokyo.ac.jp

Originally, hollandite referred to a manganese oxide mineral, Ba_xMn₈O₁₆, but now it refers to compounds with the general formula A_xM₈O₁₆ (x ≤ 2); (A = K, Rb, Ba, or Pb, etc., M = transition metals). We have successfully prepared 3d transition metal hollandites, K₂M₈O₁₆ (M=Ti, V, Cr, and Mn) by high-pressure synthesis and extensively studied their structural and physical properties. Recently, we found metal-insulator transitions (MITs) in K₂V₈O₁₆ and K₂Cr₈O₁₆. The manners of MIT are very different between K₂V₈O₁₆ and K₂Cr₈O₁₆. K₂V₈O₁₆ exhibits a first-order MIT at 170 K, accompanied by a charge order between V⁴⁺ and V³⁺ and the formation of spin-singlet V⁴⁺-V⁴⁺ pairs and V³⁺-V³⁺ pairs in the low-temperature insulator phase. On the other hand, K₂Cr₈O₁₆ is a ferromagnetic metal with T_C = 180 K, which is explained by the double exchange mechanism, but surprisingly this ferromagnetic metal phase undergoes a transition to an insulator at T_{MI} = 95 K, remaining ferromagnetic in the insulator phase [1]. By combining structure analysis by synchrotron X-ray diffraction with electronic structure calculations, this novel ferromagnetic MIT has been confirmed to be caused by the Peierls instability in the quasi-one-dimensional column made of four coupled CrO₆ chains (four-chain column); namely MIT is accompanied by lattice dimerization in the four-chain column and one extra electron per four Cr⁴⁺ is weakly localized among four Cr⁴⁺ ions (a Cr-tetramer) [2].

- [1] Hasegawa, K., Isobe, M., Yamauchi, T., Ueda, H., Yamaura, J., Gotou, H., Yagi, T., Sato, H. & Ueda, Y. (2009), *Phys. Rev. Lett.* **103**, 146403/1-4.
- [2] Toriyama, T., Nakao, A., Nakao, H., Murakami, Y., Hasegawa, K., Isobe, M., Ueda, Y., Ushakov, A. V., Khomskii, D. I., Streltsov, S. V., Konishi, T., & Ohta, Y. (2011), *Phys. Rev. Lett.* **107**, 266402/1-5.

Keywords: chromium hollandite; structure; MI transition