American Mineralogist, Volume 101, pages 2759–2767, 2016

Magnetite exsolution in ilmenite from the Fe-Ti oxide gabbro in the Xinjie intrusion (SW China) and sources of unusually strong remnant magnetization

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Abstract

This study investigates magnetite exsolution in ilmenite from Fe-Ti oxide gabbro in the Xinjie intrusion, SW China. Exsolved magnetite lamellae in ilmenite contain nearly pure Fe_3O_4 with ~1 wt% TiO_2. EBSD-based analyses indicate that the magnetite lamellae have close-packed oxygen planes and directions parallel to those in the host ilmenite with $\{111\}_{Mag}//(0001)_{Ilm}$ and $<110>_{Mag}//<10\bar{1}0>_{Ilm}$. The Fe^{2+} in the magnetite lamellae is probably derived from adjacent titanomagnetite by sub-solidus inter-oxide cation repartitioning of $Fe^{2+} + Ti^{4+} = 2Fe^{3+}$ during cooling. It is thus suggested that only Fe^{3+} cations in the magnetite lamellae should be included into the composition of the Ilm-Hem$_{ss}$ precursor for the Fe-Ti oxide oxy-thermometer. The existence of magnetite exsolution in ilmenite also provides an alternative explanation for unusually strong natural remnant magnetization in natural ilmenite.

Keywords: Magnetite exsolution, ilmenite, electron backscatter diffraction (EBSD), crystallographic relationship, sub-solidus cation repartitioning