Relations between localities, occurrences of magnetite and ratio of Fe$^{2+}$ vacancies in crystal structure of magnetite

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Ratio of Fe$^{2+}$ vacancies of magnetite can be considered as an indicator of the low-temperature oxidation. In this study, to evaluate the low-temperature oxidation of magnetite from several localities and occurrences, the ratios of vacancies were estimated from powder X-ray diffraction studies using Guinier camera. Ratios of vacancies obtained from synthetic samples are almost consistent with reference samples. However vacancy ratios obtained from natural sample were not simply depend on their occurrences.

Magnetite:Fe$_3$O$_4$ is low-temperature oxidized by Fe$^{2+}$ to Fe$^{3+}$ and its oxidation number changes with the formation of vacancies. The ratio of vacancies in the crystal structure can be calculated from the powder X-ray diffraction patterns. The ratios of vacancies obtained from synthetic samples are almost consistent with the reference samples. However, the ratios of vacancies obtained from natural samples were not simply dependent on their occurrences.

Keywords: magnetite, maghemite, Guinier camera, powder X-ray diffraction

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