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Estimation of intracrystalline distribution coefficient of Mg-Fe ions in olivine using Cs-corrected STEM

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Intracrystalline distribution coefficient of Mg-Fe ions between the two types of the octahedral sites (M1, M2-site) of olivine, $(Mg,Fe)_2SiO_4$, have been estimated using X-ray or neutron diffraction studies. Recently, the high angle annular dark field (HAADF) method using scanning transmission electron microscopy with the correction of spherical aberration (Cs-corrected STEM) visualizes the element column sites in crystalline samples. In the present study, the intracrystalline distribution coefficient of Mg-Fe ions in olivine were tried to estimate using HAADF-STEM. And furthermore, Crystal Structure Analysis of same sample was carried out using e four-circle X-ray diffractometer. We used the synthetic forsterite and the natural olivine from San Carlos, Sri Lanka and Miyake-jima. HAADF-STEM images parallel to a-axis show the Mg / Fe atom columns and the columns which alternately formed of Si and O atoms. Intracrystalline distribution coefficients estimated from the brightness in M1/M2-sites for synthetic forsterite, the olivines from San Carlos and SriLanka are good agreement with those estimated from X-ray method. On the other hand, that obtained from Miyake-jima is different with that obtained from X-ray method.

Keywords: STEM, olivine, intracrystalline distribution coefficient