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地球試料および隕石試料に見出されるエンスタタイトのカソードルミネッセンス
Cathodoluminescence characterization of terrestrial and extraterrestrial enstatite

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Enstatite occurred in meteorite shows various cathodoluminescence (CL) emissions, whereas CL emission in terrestrial enstatite has not been reported so far. We have confirmed several luminescent enstatite in terrestrial samples. In this study, we have conducted to clarify the luminescence centers of terrestrial enstatite and comparatively discuss the CL of terrestrial enstatite and extraterrestrial ones in enstatite chondrite (E-chondrite).

Three enstatite with CL emission from Morogoro, Tanzania and Chandrika, SriLanka were selected for CL measurements. The samples were fixed on a brass disk with low-luminescent epoxy resin, and polished with a diamond paste. The polished thin sections of E-chondrite (Dar al Gani 734 and Y-86004) and Aubrite (Al Haggounia 001) were employed for CL examination. Color CL images were obtained using a cold-cathode type Luminoscope with a cooled-CCD camera. CL spectroscopy was made by a SEM-CL system, which is comprised of SEM (JEOL: JSM-5410LV) combined with a grating monochromator (OXFORD: Mono CL2). The CL emitted from the samples was dispersed by a grating (1200 grooves/mm), and recorded by a photon counting method using a photomultiplier tube. All CL spectra were corrected for total instrumental response, which was determined using a calibrated standard lamp.

Color CL imaging reveals various types of CL emissions, red, blue and purple in the both of terrestrial and extraterrestrial samples. The CL spectra of these enstatite show a broad emission band at 670 nm in a red region, which is assigned to an impurity center derived from activated divalent Mn ion substituted for Mg, and a broad emission band at around 400 nm in a blue region, which might be related to a defect center such as ”intrinsic defect center” possibly raised during crystal growth.

CL spectra corrected for total instrumental response were converted into energy units for spectral deconvolution using a Gaussian curve fitting, because Gaussian curve in energy units can be assigned to one specific type of emission center (Stevens-Kalceff, 2009). The deconvoluted components can be assigned to the emission centers related to impurity centers of trivalent Cr ion (1.71 eV) and divalent Mn ion (1.87 eV) and to defect centers (3.18 eV). Furthermore, enstatite in Y-86004 E-chondrite gives additional emission component (3.87 eV) in a blue to UV region, which might be characteristic of the enstatite formed under the condition of low-oxygen partial pressure.