CATHODOLUMINESCENCE OF ENSTATITE IN E-CHONDRITE.

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Enstatite occurred in meteorites shows various cathodoluminescence (CL), whereas CL emission in terrestrial enstatite has not been reported so far. In this study, we have conducted to clarify the luminescence centers of extraterrestrial enstatite and comparatively discuss the CL of terrestrial and extraterrestrial enstatite in meteorites (E-chondrite; Dar al Gani 734, Sahara 97096 and Yamato 86004).

The polished thin sections of E-chondrite 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). 15 kV accelerating voltage, 1.0 nA current irradiation, under the conditions of the scan mode, emission spectrum of 800 nm wavelength range 300 nm ~. Spectral data obtained were subjected to sensitivity correction for the spectrometer and the detector. Further, the composition of enstatite EPMA: was quantitatively analyzed using the (JEOL JXA-8900). 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 these 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 data were converted into energy units for spectral deconvolution using a Gaussian curve fitting, because one 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 center (3.18 eV).

The results reveal that the emission centers estimated from the CL spectra in terrestrial and extraterrestrial enstatite are almost same among them, suggesting CL color caused by manganese activator for red emission and defect center for blue emission. According to WDS analysis of terrestrial enstatite, blue CL enstatite has relatively high content of Al_2O_3 (1.2 wt.%) rather than purple one (Al_2O_3: 0.8 wt.%). This fact implies that the defect center at 3.18 eV might be related to the lattice distortion derived from interstitial aluminum ion, suggesting the formation of the enstatite in E-chondrite at high temperature.