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PPS05-P02 会場:コンベンションホール 時間:5 月 25 日 15:30-16:45

隕石およびインパクタイトに含まれるマスケリナイトのカソードルミネッセンス
Cathodoluminescence of maskelynite in meteorite and impactite

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Maskelynite is an important material in planetary sciences to interpret shock metamorphic effects on impactite and meteorite. Recent scientific interests, therefore, focus on the formation processes of maskelynite by shock metamorphism, but it has been uncertain whether maskelynite is produced by shock-induced amorphization of plagioclase in solid-state reaction or by quenching from shock-induced dense melts of plagioclase at high-pressures. Cathodoluminescence (CL) spectroscopy can reveal crystal-chemical properties for the existence and distribution of defects and trace elements in materials with high-spatial resolution, which should be more informative to shock-induced minerals. This technique is expected to clarify a formation process of maskelynite from feldspar. In this study, CL analysis of maskelynite and K-rich feldspar glass in impactite and meteorite, as well as diaplectic glass derived from shock experiment for feldspars has been conducted to interpret shock-induced effects on a glassification of the feldspar.

Maskelynite and K-rich feldspar glasses originated from K-feldspars (K-feldspar glass) in amphibolite from Ries crater and in Martian meteorites of Dhofar 019, Shergotty, Zagami and NWA 2975 and lunar meteorite of NWA 4734 were employed for CL measurements. Single crystals of sanidine from Eifel, Germany, albite from Minas Gerais, Brazil and andesine from Bekily, Madagascar were selected as starting materials for shock recovered experiments at pressure of 40.1 GPa. Synthetic hollandite-$KAlSi_3O_8$ and meteoritic Na-lingunite from Y-790729 were analyzed as reference materials to compare their CL data with those of the feldspar glasses.

CL spectra of maskelynite and K-feldspar glasses in impactite and meteorites consist of emission bands at 330 and 380 nm. Similar UV and blue CL emissions are also recognized in CL spectra of diaplectic glasses derived from the shock recovered sanidine, albite and andesine. The deconvolution of CL spectra in the UV-blue spectral region for maskelynite, K-feldspar glass and diaplectic glasses originated from shock experiment indicates Gaussian components at 3.88 and 3.26 eV, which have been undetectable in the unshocked feldspars. The emission components are, therefore, characteristic CL signals of maskelynite, K-feldspar glasses and diaplectic glass derived from the shock recovered feldspars. CL spectra of the hollandite-$KAlSi_3O_8$ and Na-lingunite also show emission bands at 330 and 380 nm, which can be deconvoluted into the components at 3.88 and 3.26 eV. These emission intensities are appreciably higher than those of maskelynite, K-feldspar glass and diaplectic glass obtained from shock experiment. This might be responsible for octahedral coordination of all Si and Al atoms in the former and some of them in the latter. The facts imply that the emission components might be assigned to shock-induced defect centers in the Al and Si octahedra produced at high pressure. Furthermore, diaplectic glasses from disordered feldspar tend to exhibit higher intensities of the components at 3.88 and 3.26 eV than those from ordered feldspar at same shock pressure, possibly arising from a difference in the transition shock pressure into diaplectic glass among the feldspars. Accordingly, the CL signals can be applied as an estimation method for the degree of Si-Al order in the original feldspar affected before shock impact.

CL images of the lunar meteorites revealed that the maskelynite contacted with or located near melt pockets has a dull CL emission compared to those far from ones. This might be explained by either an elimination of the shock-induced defect centers in diaplectic glass by annealing or a difference in the formation process between dull and bright CL areas, that is, diaplectic glass and glass quenched from a shock-induced dense melt at high pressure.

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