Cathodoluminescence halo in albite

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Cathodoluminescence (CL) halo in quartz caused by alpha-radiation has been investigated for the application to geodosimetry. The halo in feldspar minerals, however, has not been studied from the point of view of CL. In this study, CL of various albite implanted by He^+ ion have been measured for identification of their CL features and application to geodosimetry and geochronology.

Single crystals of albite ($Ab_{99\sim100}Or_{1\sim0}$) from Minas Gerais, Brazil, Niigata, Japan and Shiga, Japan were selected for CL and Raman measurements. He^+ ion implantation on the sample was performed using a 3M-tandem ion accelerator at 4 MeV corresponding to the energy of alpha-particles from ^{238}U. A scanning electron microscopy-cathodoluminescence (SEM-CL) was used to measure CL spectra ranging at 15 kV with an incident beam current of 1.0 nA.

CL images of albite from Minas Gerais exhibit CL halo on the surface of He^+ ion implanted sample. Approximately 15 μm width of CL halo in the section is consistent with theoretical range of alpha-particles from disintegration of ^{238}U in albite. CL intensity increases exponentially from implanted surface to the inside, with its maximum at approximately 15 micron meters from the surface. CL spectra have an emission band at around 700 nm in the red region. Its intensity positively correlates to radiation dose of He^+ implantation. Raman spectroscopy reveals that He^+ implantation causes no obvious structural change in CL halo area. These results suggest that CL emission band at around 700 nm might be assigned to radiation induced luminescence centers formed by He^+ ion implantation. This peak was recognized in only albite from Minas Gerais.

In the case of sanidine its CL shows blue and red emission bands assigned to Al-O^--Al and Fe^{3+}, of which CL intensities decrease with an increase in radiation dose of He^+ implantation. He^+ implantation causes breakage framework, suggesting a reduction of emission centers related to its emission bands. Albite, however, shows no obvious structural change in CL halo area. It indicates that He^+ implantation produces radiation induced luminescence center without framework destruction. CL and Raman spectroscopy for albite from Niigata and Shiga will be discussed here.

Measurements of high-energy neutron cross sections for accurate cosmogenic nuclide production rates

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Monte Carlo neutron transport codes are essential tools in model calculations of cosmogenic nuclide production rates in terrestrial and extraterrestrial materials. However, even when the fundamental physics of neutron transport within planetary materials is modeled properly, the reliability of the results is still limited by the lack of measured pertinent cross sections. At the present time, the largest uncertainty in cosmogenic nuclide production rate models is the uncertainty or lack of the excitation functions for nuclides produced by high-energy neutrons that dominate production of cosmogenic nuclide. To improve the accuracy of cosmogenic nuclide production rates we are extending measurements of the high-energy neutron excitation functions [1].

Various target materials were exposed to monoenergetic neutrons at the Research Center for Nuclear Physics (RCNP), Osaka University; the neutrons are prduced utilizing the reaction beams by ^{7}Li(p, n). The first irradiation was performed using a 392 MeV primary proton beam. After measurement of the short half-lived nuclides by low-level γ-ray counting [2. 3] we started measurements of the long-lived nuclides by AMS and by noble gases mass spectrometry. We will present high-energy (~40-390 MeV) neutron cross sections for ^{10}Be, ^{26}Al, ^{36}Cl, and ^{21}Ne from various target elements.

[1] Imamura *et al.* (1990) *NIM* **B52,** 595-600. [2] Ninomiya *et al.* (2008) *Ann. Mtg. Japan Soc. Nucl. Radiochem. Sci.* [3] Omoto *et al.* (2008) *ibid.*