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SIT037-02 会場: 展示ホール7別室2 時間: 5月27日 11:00-11:15

高圧力下で変形された立方晶系多結晶試料の選択配向成長のその場観察

In situ observation of texture development in cubic polycrystalline materials under controlled deformation

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Rheological property of mantle minerals is of fundamental importance in understanding dynamic process in the Earth. Deformation experiments have been conducted extensively to understand flow mechanisms of rocks and minerals. However, due to limitations in controlled confining pressure in quantitative deformation experiments, our knowledge of rheology for the deep interior of the Earth is still poor. Our high-pressure deformation module, which was modified from cubic anvil high-pressure apparatus, has expanded pressure and temperature range for deformation experiments, but majority of the studies have been focused on in situ stress and strain measurements. Here, we present a method to extract the sample texture by analyzing azimuth angle dependence of X-ray diffraction intensity based on the monochromatic technique. The polycrystalline samples deformed have a cylindrical symmetry and generally exhibit a fiber texture. The technique to estimate possible slip system(s) from the fiber texture is also given. On the basis of these techniques, in situ texture observation of polycrystalline MgO and CsCl has been conducted at the GSECARS beamline of the Advanced Photon Source (APS). Polycrystalline MgO and CsCl are revealed to develop 200 and 111 fiber texture at pressures up to 10 GPa with possible dominant slip system of {110}<1$\bar{1}$0> and {110}<001>, respectively. These active slip systems are consistent with the initial yield points obtained in stress and strain measurements: In our lattice strain vs. total strain plot, 110 lattice strain for both MgO and CsCl yields first. Our results of active slip systems are also consistent with previous studies using conventional tensile and compression test, attesting that our technique can be used as a modification of these conventional tests at higher pressure. High pressure and temperature deformation experiments for MgO reveal strong texture development under low flow stress, suggesting that even for minerals with relatively low anisotropy, e.g., cubic symmetry, texture-induced seismic anisotropy may be significant.