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Application of Synchrotron Radiation to High Pressure Mineral Physics of Earth's Core

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Synchrotron Radiation is a useful tool to clarify the Earth's deep interior. Here I would like to present the applications of synchrotron radiation to high pressure mineral physics. We apply this intense X-ray to study the properties and phase and melting relations of the Earth's materials which can be applied to the Earth's deep interior. We use various techniques such as X-ray diffraction and spectroscopy. Here I show examples of the use of the synchrotron radiation such as inelastic X-ray scattering at high pressure to determine the sound velocity of the iron alloys, candidate materials of the Earth's inner core, and X-ray diffraction study at high pressure and temperature to clarify the phase and melting relations of iron-alloys of the Earth's core. We conducted the sound velocity measurements of hcp-iron and hcp and B2 (bcc) Fe-Ni-Si alloys by using the inelastic x-ray scattering at high pressure. We achieved the sound velocity measurements to the pressure of the Earth's inner core exceeding 300 GPa. We also studied of the phase relations of the Fe-Ni-Si system to the core pressures, indicating the coexistence of hcp and B2 (bcc) phases at high temperature near the melting point suggesting a possible coexistence of a two-phase mixture in the Earth's inner core. CPM (Commission of Physics of Minerals) of IMA is encouraging the use of synchrotron radiation. These studies are such examples and clearly show that the synchrotron radiation is a powerful tool for the study of the center of the Earth.
References:
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Primary author: OHTANI, Eiji (Tohoku University)

Presenter: OHTANI, Eiji (Tohoku University)

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