Determination of single crystal elasticity and equation of states based on meV-IXS

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Abstract
Single crystal elasticity is one of basic physical properties for materials. We have presented a method to determine this property precisely based on meV-IXS spectra (Fukui et al., 2008). This technique can be adapted to a tiny sample with irregular shape or opacity because hard x-ray as a probe of meV-IXS can be easily focused down to micron size and has a relatively high penetrability, and because its refractive index of x-ray is almost unity independently to a type of materials. The wavelength of the x-ray probe also enable us to determine the crystal orientation of the sample using the same measurement instrument for meV-IXS.
The high penetrability of x-ray is also effective for samples under extreme conditions. Simultaneous measurement of a molar volume and an elasticity of a material yields an equation of states (EoS) of the material independently to other pressure standards by numerically integration of a bulk modulus. We have measured single crystal elasticity of pressure-standard materials and demonstrated to establish absolute pressure scales (Yoneda et al, 2017; Kamada et al., 2019; Fukui et al. 2020). We review how to establish EoSs based on single crystal elasticity as well as some tips to determine single crystal elasticity from meV-IXS spectra.

Reference
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