

Zirconium local structure in tektite and impact-related natural glasses probed by XAFS

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The local structures of tektite and natural glasses were studied by Zr K-edge X-ray absorption near edge structure (XANES) and extended X-ray absorption fine structure (EXAFS) in order to provide quantitative data on bonding distances and coordination numbers. The XAFS measurements were performed at the beam line BL-NW10A of the PF-AR in National Laboratory for High Energy Physics (KEK), Tsukuba, Japan. Zr⁴⁺ ion in tektite has different kinds of coordination environment. Various natural glasses are formed under different physical conditions. Impact-related glass, fulgurite and volcanic glasses are typical natural glasses. Glass structure is affected by the pressure and temperature conditions during the glass formation and annealing process. This study indicated that different formation process of natural glasses gives different local structure of zirconium ions.

The Zr K-edge XANES spectra of tektite have the double post-edge peaks with different heights. All tektites are classified in same types. Zr-O distances in tektite are 2.198-2.215 Å and XANES spectra of tektite have similar shape. It indicates that tektites have similar Zr local structure with 7-fold coordination Zr ions. Volcanic glasses are classified same type. Impact-related glasses are classified to different types. Impact glasses are formed under different geological process at impact event and are experienced different physical environments.

Keywords: XAFS, Local structure of Zr, Tektite, Natural glass, XANES, EXAFS