

# Structural study of phase transformation in B<sub>2</sub>O<sub>3</sub>-glass under high pressure

Vadim BRAZHKIN<sup>1)</sup> Yoshinori KATAYAMA<sup>2)</sup>

Hiroyuki SAITOH<sup>2)</sup> Takanori HATTORI<sup>2)</sup>

<sup>1)</sup>Inst. High Pressure Phys., Russian Academy of Sciences    <sup>2)</sup>JAEA

The structural transformation of B<sub>2</sub>O<sub>3</sub> glass under high pressure was investigated by in-situ x-ray diffraction experiments. Strong modification of the 2nd and 3rd coordination spheres was observed.

キーワード : B<sub>2</sub>O<sub>3</sub>、ガラス、高圧、構造変化

## 1. 目的

The purpose of the study was to investigate the structural aspects of the hypothetical coordination phase transformation in B<sub>2</sub>O<sub>3</sub> glass by in-situ high-pressure x-ray diffraction experiments. B<sub>2</sub>O<sub>3</sub> glass is the “classical” network glass which has 3 oxygen neighbors around boron atoms and 2 boron atoms around oxygen. Under high pressure this glass undergoes some transformation: in 6-14 GPa region the intensity of the Raman peak at 808 cm<sup>-1</sup> drastically decreases, the elastic constants determined by the Brillouin scattering significantly increases, inelastic X-ray scattering intensity strongly modifies etc [1-3]. Thus direct structural study of glassy B<sub>2</sub>O<sub>3</sub> was strongly needed to clarify the nature of the transformation at 6-14GPa region.

## 2. 方法

We carried out in-situ high-pressure high-temperature x-ray diffraction measurements on B<sub>2</sub>O<sub>3</sub> glass using a cubic-type large-volume press installed at BL14B1 beam-line at SPring-8. We used energy dispersive technique and have got spectra at 2θ ranged from 3 to 24 degrees.

## 3. 研究成果

X-ray diffraction spectra were recorded more than in 20 P, T- points up to 9.5 GPa both during pressure increase and during decompression. The significant structural changes were observed at compression between 6 and 9.5 GPa. The relative ratio of the height of the 1st and 2nd peaks of the structural factor changes by several times. At maximum pressures the relaxation behavior was observed: the structure changes vs time (several hours scale). The transformation is strongly accelerated by temperature treatment below crystallization temperature (300-350°C). The observed structural change is almost reversible: the reverse transition occurs at 1-4 GPa range with jump-wise behavior at 1.5 GPa. At room pressure after decompression the structure of the glass is quite similar to the pristine one. The reminder densification is around 6-8%.

## 4. 結論・考察

The preliminary data analysis showed that the observed transformation is associated with strong modification of the 2nd and 3rd coordination spheres, but 1st coordination sphere almost does not change. It means that the observed transformation may not be connected with the increase of the 1st coordination number from 3 to 4 as currently supposed. The quantitative analysis of the structural data is in progress.

## 5. 引用(参照)文献等

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