

Neutron Diffraction Study of Isotope Enriched Glassy $\text{Sm}_4\text{Ti}_9\text{O}_{24}$

K. Maruyama^{1#}, Y. Arai², S. Sato¹, M. Sanada¹, T. Otomo³, K. Suzuya⁴ and K. Itoh⁵

¹ Faculty of Science, Niigata Univ., Niigata 950-2181, Japan

² ISAS, Japan Aerospace Exploration Agency, Tsukuba, Ibaraki 305-8505, Japan

³Institute of Materials Structure Science, KEK, Tsukuba, Ibaraki 305-0801, Japan

⁴J-PARC Center, JAEA, Tokai, Ibaraki 319-1195, Japan

⁵ Graduate School of Education, Okayama Univ., Okayama 700-8530, Japan

a corresponding author: E-mail maruken@sc.niigata-u.ac.jp

High refractive-index glasses are key elements for downsizing digital cameras and an endoscope. The refractive index of $\text{Sm}_4\text{Ti}_9\text{O}_{24}$ glass ($n=2.32$ at 633 nm) is higher than those of $\text{Ln}_4\text{Ti}_9\text{O}_{24}$ glasses ($\text{Ln}=\text{La}$ and Nd) and is compatible with the index of TiO_2 thin film ($n\sim 2.4$), which is the maximum refractive index of transparent disordered materials. In order to investigate the coordination structure of oxygen atoms around metal atoms the neutron scattering measurements were performed.

The samples were glassy $^{152}\text{Sm}_4\text{Ti}_9\text{O}_{24}$, $^{154}\text{Sm}_4\text{Ti}_9\text{O}_{24}$ and $^{154}\text{Sm}_4\text{Ti}^0_9\text{O}_{24}$, where Ti^0 means the null scattering mixture of Ti isotopes. The glassy samples were made with the container-less gas floating technique and their diameter was about 2 mm. The total neutron scattering measurements were carried out with NOVA spectrometer at MLF in J-PARC. The samples were sealed in cylindrical vanadium cells of 0.1 mm thick and were set to the sample changer with an empty cell and a vanadium rod.

Figure 1 shows the total structure factor $S(Q)$ for each sample. Because the neutron scattering lengths of ^{152}Sm and ^{154}Sm have the opposite sign, the $S(Q)$'s drastically differ from each other. By performing the reverse Monte Carlo modeling with three $S(Q)$'s it is possible to derive the partial structure information, such as interatomic distances and coordination numbers. The precise analysis is in progress.

The neutron scattering experiment was approved by the Neutron Science Proposal Review Committee of J-PARC/MLF (Proposal No. 2012B0198) and supported by the Inter-University Research Program on Neutron Scattering of IMSS, KEK. This work was supported by JSPS KAKENHI Grant Number 23560814.

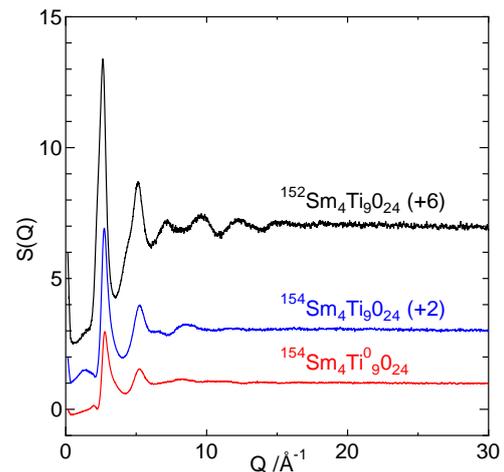


Fig. 1 The total structure factor $S(Q)$ of glassy $\text{Sm}_4\text{Ti}_9\text{O}_{24}$ obtained with the isotope substitution technique.