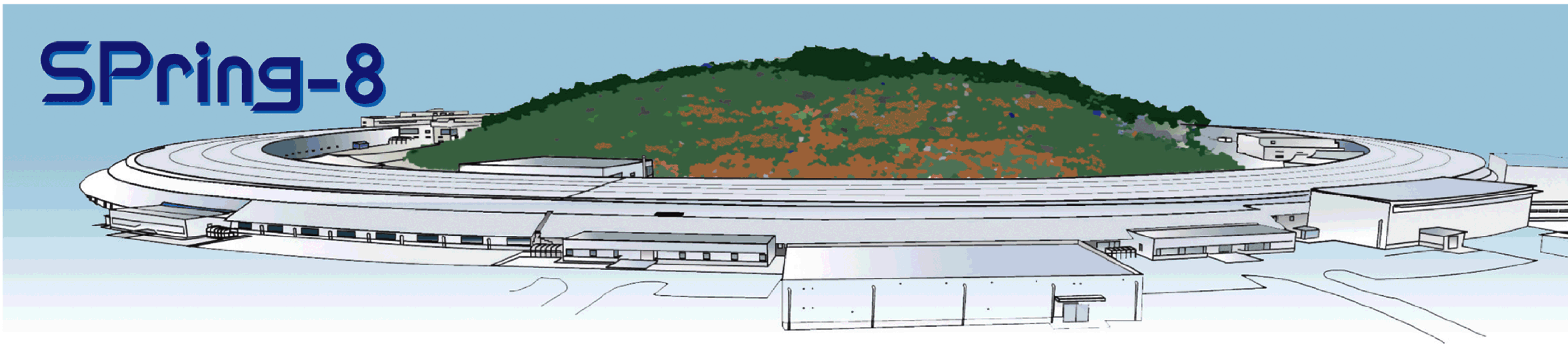

Revealing relationship between Glass Forming Ability and Atomic Arrangement

Obtaining clues about how glass is formed

Japan Synchrotron Radiation Research Institute (JASRI) organized an international joint research team with Tempere University of Technology, Yamagata University, Japan Atomic Energy Agency, Materials Development Inc., Aberystwyth University, and Argonne National Laboratory to examine the relationship between glass forming ability and atomic arrangement, for the first time in the world, by measurement using high-brilliance and high-energy synchrotron X-rays at SPring-8 and by computer simulation. The results of this study will provide important knowledge for solving the unresolved problems underlying how glass is formed.

Glass is indispensable to our daily lives because most glass is transparent, hard, resistant to chemicals and has a smooth surface. The atomic structure of glass is not ordered as in crystals; therefore, it is difficult to understand its structure. A typical glass synthesis method is to produce a melt from a solid substance at a high temperature and then cool the melt. When the cooling rate is too low, the melt is crystallized and the resulting product does not have the properties of glass.

Enstatite and forsterite are known as principal minerals constituting the Earth. Their melts and the structures and properties of their glasses have been investigated by many researchers. Although both enstatite and forsterite include silica (SiO_2), which is required to form glass, silica-rich enstatite forms glass more easily than forsterite. A high-temperature melt of forsterite is easily crystallized simply by rapid cooling and is vitrified into a glass bead by containerless processing (Fig. 1). In this study, the difference of the ring distribution in the atomic arrangement of enstatite and forsterite glasses with different silica contents was discovered for the first time, and the relationship between the ring distribution and glass forming ability was revealed (Fig. 2).

The achievement of this study will provide important infromation relating the glass structure, which has been examined since early days, to the theory of glass formation.

Reference: S. Kohara, J. Akola, H. Morita, K. Suzuya, J. K. R. Weber, M. C. Wilding, and C. J. Benmore; *Proceedings of the National Academy of Sciences of the United States of America* **108**, 14780-14785 (2011)

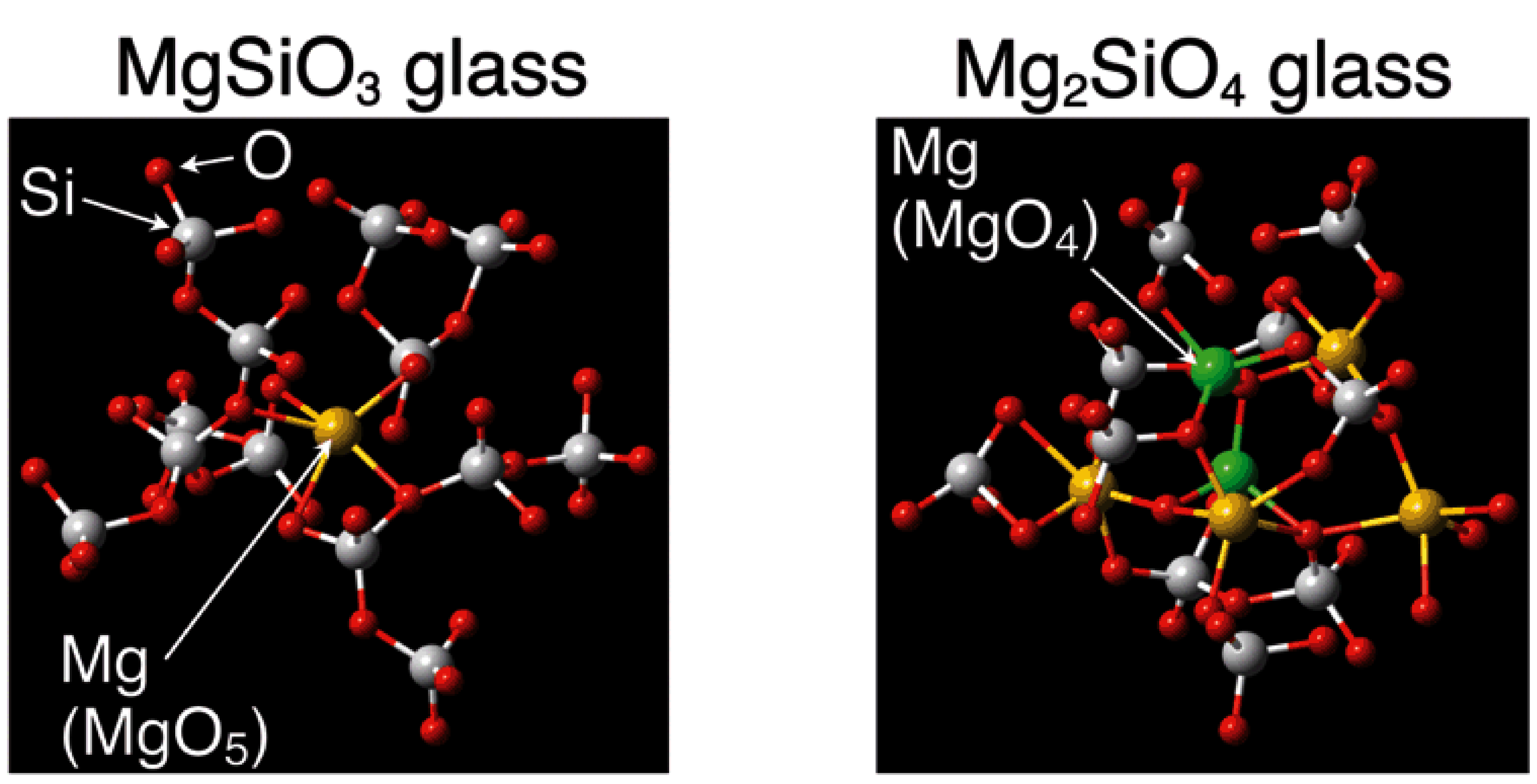

Fig. 1 Structure of $MgSiO_3$ and Mg_2SiO_4 glasses

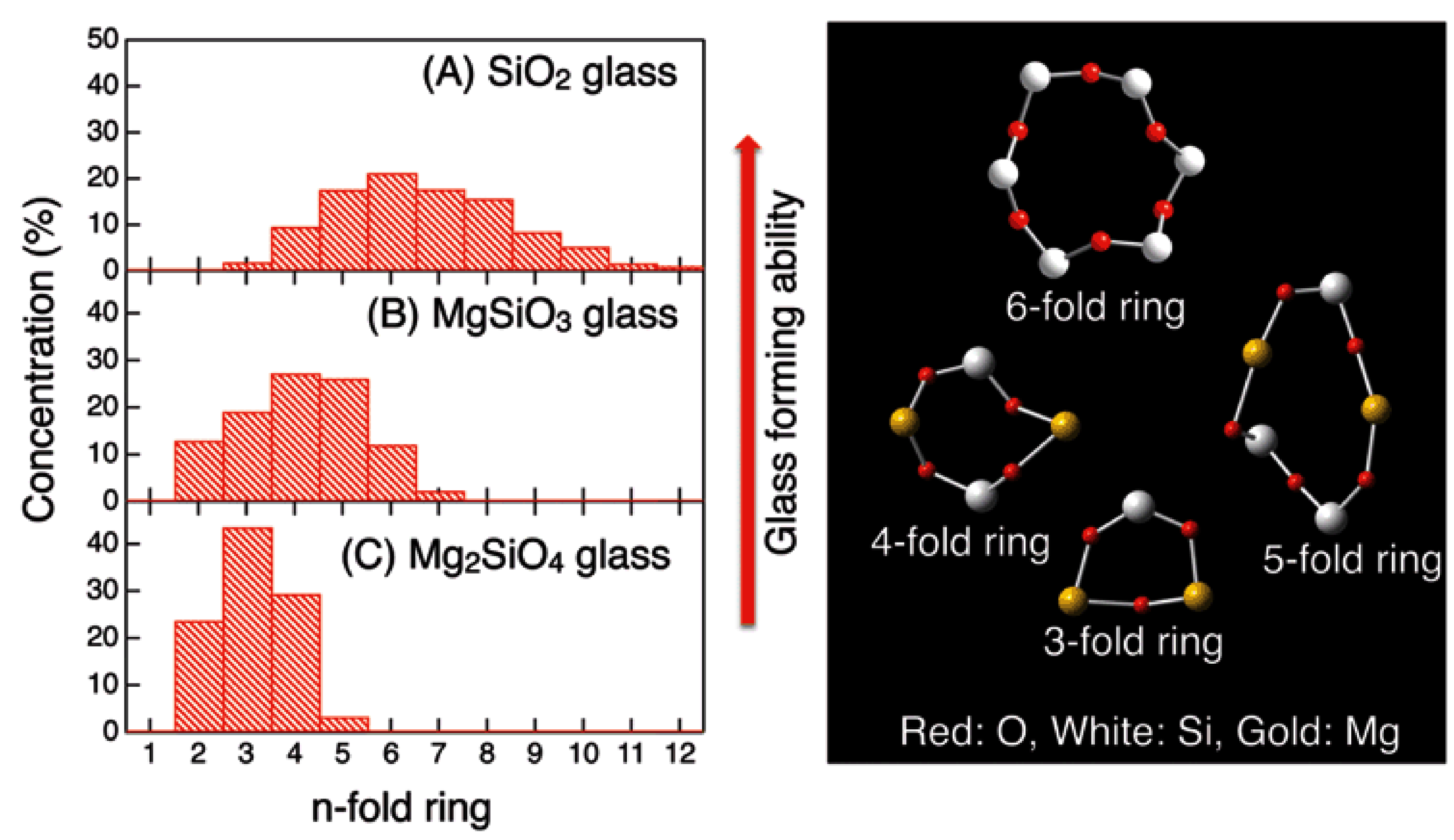

Fig. 2 Ring distribution in glass
The lower the silica (SiO_2) content, the narrower the ring distribution, making it more difficult to form a glass.