Thermal Stability of Fe-Based BMGs Investigated by High-Energy X-ray Scattering

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Abstract. The present work focuses on the thermal stability study of Fe-based bulk metallic glasses (BMG) during thermal cycling in the range from room temperature up to 730 °C. Structural changes were investigated by means of in-situ high-energy X-ray scattering (HEXS) of synchrotron radiation. Special emphasis was placed on investigation of thermal expansion behavior of selected Fe-based BMGs during cycling heating and cooling. Observed structural changes were related to thermally induced structural relaxation of amorphous structures that was evaluated as irreversibility observed between heating and cooling expansion curves. X-ray data were analyzed in reciprocal space by tracing position of the principal diffuse peak. The study of the local atomic structure was further complemented by analysis in real space by means of pair distribution function. Reciprocal and real space analyses differ in the length scale they are sensitive to, and thus offer unique approach to study thermal expansion behavior of amorphous alloys on short-range (1.8 – 3.3 Å) as well as medium-range (6 – 15 Å) order.