

Fabrication and Industrialization of Large-Sized Bulk Metallic Glasses of Centimeter-Size Class

Akihisa INOUE

(Tohoku University, President)

【Outline of survey】

The present project aims to fabricate large-sized bulk metallic glasses of centimeter class (L-BMGs/cm) with critical diameters over 1 cm in a wide range of multicomponent alloys in Zr-, Ti-, Mg-, Lanthanide(Ln)-, Fe-, Co-, Ni-, Cu-, Pt- and Au-based systems. In order to complete this mission, we will carry out researches on the following five items. (1) Search for the most appropriate multicomponent alloy systems, (2) Development of processes and relevant techniques required to fabricate L-BMGs/cm, (3) Clarifications of peculiar local atomic arrangements and the reason for extremely high glass-forming ability of L-BMGs, (4) Predictions of appropriate compositions for the formations of L-BMGs, based on the local atomic arrangements and phase stability of these L-BMGs with the aid of computer simulation by the establishment of the appropriate computational procedures, (5) Sample tests to evaluate the properties described below. The samples are supposed to be in a metallic glassy single phase state, composite phases containing inclusions of nanometer-sized clusters, nanocrystalline phase, nanoquasicrystalline phase and dendritic crystalline phase, and their various properties are to be measured. By summarizing results for the above five items, we will be able to fabricate L-BMGs with a critical diameter exceeding several centimeters, which have not yet been obtained to date. In addition, we will understand and solve a variety of issues inherent to large-sized samples. Furthermore, we will accumulate the fundamental findings to judge the possibility to fabricate super-L-BMGs with diameters of several tens of centimeters. These fundamental researches throughout the present project will lead to further development of materials science application fields by using newly-developed L-BMGs as new base materials, and will contribute to build extremely safe and secure society where people live wealthy.

【Expected results】

We believe that the present original and novel project is able to be drafted and accomplished by our group only. Accordingly, the expected results, which are to be obtained in the present project, are listed below in terms of the following three items. (1) In five years, we will produce L-BMGs/cm with critical diameters of several centimeters in various alloy systems. (2) We will fabricate these L-BMGs by utilizing extremely highly-stabilized supercooled metallic liquids as well as clarify their fundamental and functional properties. (3) During our research on these L-BMGs/cm we will establish new fundamental aspects to be used in various other fields as new engineering materials, which contribute to human society.

【References by the principal investigator】

- A. Inoue: *Stabilization of Metallic Supercooled Liquid and Bulk Amorphous Alloys*, Acta Mater., 48(2000), 279-306.
- A. Inoue: *Bulk Glassy and Nonequilibrium Crystalline Alloys by Stabilization of Supercooled Liquid: Fabrication, Functional Properties and Applications (Part 1)*, Proc. Jpn. Acad. Ser. B-Phys. Biol. Sci., 81(2005), 156-171.

【Term of project】 FY2008—2012

【Budget allocation】

157,600,000 yen (direct cost)

【Homepage address】

<http://www.wpi-aimr.tohoku.ac.jp/en/index.html>