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Recent Development and Applications of Bulk Glassy Alloys

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Abstract – In this presentation, we aim to introduce recent advanced results on the fundamental and application aspects of bulk glassy alloys and investigate future prospects of bulk glassy alloys as engineering materials.

For the past several years, we have found some new bulk glassy alloys with unique characteristics based on technologically-important transition metal base systems such as Zr-, Ti-, Fe-, Co-, Ni- and Cu-based alloys. We have succeeded in achieving the maximum diameter for glass formation as large as 32 mm for Zr-based system, 10 mm for Ti-based system, 18 mm for Fe-Co-based system, 25 mm for Ni-based system and 30 mm for Cu-based system, even employing the conventional copper mold casting technique.

These large size bulk glassy alloys possess nearly the same fundamental properties as those for the corresponding bulk glassy alloys with diameters of millimeters.

We have further reported that bulk glassy alloys with diameters above 10 mm are formed in new Ni-free Zr- and Ti-based alloy systems and these Zr- and Ti-based bulk glassy alloys exhibit good mechanical properties and high corrosion resistance. The new Ti- and Zr-based bulk glassy alloys without allergic and toxic elements also exhibit good compatibility to bio-tissues, which can be regarded to be promising for a new type of biomedical material, in addition to high strength, compressive ductility and high corrosion resistance.

Applications stages of bulk glassy alloys in Fe-, Co-, Ti- and Zr-based systems have been advanced as the following devices, e.g., choke coil, power inductor, electro magnetic shielding, magnetic sensor, position sensor, micro-geared motor, pressure sensor, Colliori-type mass flow meter, high corrosion resistant surface coating layer, precise surface polishing material, magnetic, gear and structural parts in electric magnetic control-type spring drive watches, medical operation instruments and so forth.

In this presentation, we aim to introduce recent advanced results on the fundamental and application aspects of bulk glassy alloys described above and investigate future prospects of bulk glassy alloys as engineering materials.