

Attractiveness and Commercialization of Zr- and Fe-based Bulk Metallic Glasses

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Since the syntheses of BMGs by copper mold casting around 1990, a large number of BMGs have been prepared for various alloy systems in the diameter range up to 8 cm. These BMGs exhibit unique mechanical properties such as high strength, low Young's modulus, high elastic strain, low friction coefficient and high wear resistance which cannot be obtained for crystalline alloys. BMGs also exhibit low coefficient of shrinkage in the liquid-solid solidification transformation and hence can have good castability. Besides, all BMGs show glass transition, followed by a large supercooled liquid region before crystallization and have good nanoscale imprintability through viscous flowability. By utilizing good combination effect of suitable multicomponent alloy composition and direct liquid production process, BMGs have been commercialized as various engineering materials such as smartphone parts, smartphone case, drone parts, geared motor parts, pressure sensor, buckle parts for automobile door, kitchen knife, watch casing, substrate plate and vessel for structural analyses, sporting goods, ornaments etc. On the other hand, Fe-based soft ferromagnetic BMGs exhibit high glass-forming ability, rather high saturation magnetization, low coercivity, high effective permeability, high electrical resistivity, high strength and high corrosion resistance. As a result, Fe-based glassy alloy powder cores can be easily produced on a mass scale and their cores have been used as power inductors and converters in notebook personal computers and mobile phones etc. Besides, Fe-based BMGs have been used as a surface coating material

with high hardness, corrosion resistance and high wear resistance. The total sailing money is estimated to reach about 8.3 billion USD for Zr-Al-Ni-Cu base BMGs and about 2 billion USD for Fe-based BMGs. Considering the increasing ratio of the sailing money by about 30 % per year for the last several years, the importance of BMGs as advanced engineering materials is expected to increase steadily in the near future. This paper intends to introduce the attractiveness, engineering characteristics, present commercialization state and future prospect of BMGs.