Vitrification processing of molten alloys

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Glassy alloy is characterized by its own unique loosely packed random structure and some properties originate to the unique random structure; i.e. thermoplastic deformation due to glass transition phenomena and inhomogeneous deformation due to no operable dislocation. By the optimization of homogeneity and glassy solidification process of molten alloy, vitrification can be achieved in various scales from centimeter-sized rod to nanowire or single micrometer powder. In this presentation, I would like to talk about my resent two topics;

1.Casting ~Micro factory concept for cast glassy alloys~ [1]

Good reproducibility should be achieved for standardization and industrialization of cast glassy alloys. The Automatic fabrication system, which composed of automatic weighing, alloying and casting, was developed to achieve good reproducibility. Pre-alloying process was also examined to suppress the formation of harmful intermetallic compound during melting mixture of raw metals (alloying). Making full use of the automatic fabrication system and prealloying process, meaningful progress will be expected on the advanced quality control of cast glassy alloys, in addition, the process promises the avoidance of human error and dependence on human skill.

2. Atomising ~Fe-based glassy alloy fine powders~ [2]

Powder metallurgy is one of suitable processes to mould glassy alloys into industrial products with reasonable price, however, present conventional powder making processes (gas and water atomisation) seem difficult to reduce the price of glassy alloy powders. Therefore, new categorized atomisation process for Fe-based glassy alloy powders had been tried to develop by using high velocity air fuel flame (HVAF), and the process is named counter flame jet atomisation (CFJA). This CFJA, which can be expected to produce small sized powder (i.e. single micro meter in diameter) by its unique atomisation conditions of high temperature (~1600 °C) and high velocity (~1600 m/s), enables to fabricate glassy $Fe_{73.2}Cr_{2.2}Si_{11.1}B_{10.8}C_{2.7}$ fine powders with combination of specified cooling system.

[1] http://www.diavac.co.jp/english/products/souti/kogata-a-ku/index.html
[2] http://www.tohoku.ac.jp/english/2013/01/press20130125-01.html