

New High Strength Bulk Metallic Glasses and Nanophase Alloys

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Abstract:

Very large bulk metallic glasses of Zr-Cu-Ni-Be and Zr-Ti-Cu-Ni-Al systems with low critical cooling rates of 10K/s or less were produced in the various forms of rod, up to 14mm in diameter, plate and wire by casting methods which are completely different from the ordinary rapid quenching method. Some compositional phase diagrams were constructed and presented. For a Zr-Ti-Cu-Ni-Be amorphous alloy the eutectic temperature of the alloy, T_m was 937K, while the glass transition temperature T_g was 625K. This shows the highest $T_g/T_m(=0.67)$ value reported so far metallic alloys and is consistent with the exceptional glass forming ability of the material which has been studied. Some structural, mechanical and thermodynamic properties of the new material were investigated using XRD, FIM, SEM, DSC, USG. A typical Ti-base glass alloy has $Y.S=400(KSI)$, $Density=0.18(\#/in^3)$ and $Y.S/Density=2222$. Present new glass alloys are high strength (1.5-3GPa) materials, never-the-less they are highly processable and machinable in the undercooled liquid regime. The alloy glass surface exhibits extremely low sliding friction coefficient.