

**DEVELOPMENT, CHARACTERIZATION, AND APPLICATIONS OF  
GOLD AND PLATINUM BULK METALLIC GLASSES**

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To My Parents

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## ABSTRACT

The development of bulk metallic glass alloys is presented with various elemental selection criteria, design strategies, and experimental techniques. The focus was later drawn towards the development of noble bulk metallic glasses based on gold and platinum. To formulate a good bulk glass forming composition, we found that the gold alloys had to be optimized using uncommon approaches. One strategy was to primarily increase the glass transition temperature of the alloy, instead of lowering the melting temperature. The resulting gold bulk metallic glass alloy could be cast fully amorphous up to 5 mm thick. However, the best gold glass former also exhibited many anomalous behaviors; for example, a very high strain rate could induce phase separation in the bulk glass forming liquid. A detail study on the strain rate induced crystallization was carried out systematically to pinpoint the exact conditions that would cause an anomaly.

Additionally, a variety of comparative studies were conducted on the gold and platinum bulk metallic glass alloys, including elastic constants measurement, heat capacity measurement, viscosity measurement using three-point beam bending, and time to crystallization study in order to construct a Time-Temperature Transformation diagram.

The last chapter switches gears to the engineering and technology aspect of gold and platinum bulk metallic glasses. The thermoplastic soldering technique is introduced as a novel method for joining any two materials at temperatures lower than that of brazing or welding processes. The proposed technique is a new alternative to the lead-free soldering process available to the electronic industry.

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