Nanoforming of Metallic Glass Materials

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In this research, metallic glass materials, also known as amorphous alloys, will be formed to produce nanoscale features. Metallic glass materials exhibit Newtonian fluid characteristics at a temperature above their glass transition temperature but below their recrystallization temperature. This allows features in female dies to be accurately replicated through elevated temperature forming when the material is in this super cooled liquid state. To date, research has shown that features as small as 100 nm are able to be replicated (Saotome et al., 2002), but this is primarily limited by the features in the die. This work will evaluate the capabilities, accuracy, and tooling durability of replicating features at the nanoscale with this technique. The advantage of this nanoforming technique over other fabrication processes is that thousands of parts can be produced from a “master” die, which will be fabricated from a more costly and time consuming process such as e-beam lithography, Dip Pen Nanolithography, etc. Potential applications of these formed parts within the Center for High-rate Nanomanufacturing are tooling for the injection molding process or the substrate for nanoscale memory device. This research is being conducted in collaboration with LiquidMetal® Technologies.

Features created in metallic glass material

![Features](from Saotome et al., 2002)