Self-standing process by using bimetallic effect of thin-film metallic glass

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Abstract

In this study, we attempted to fabricate microstructures that can stand independently at angles greater than 90 degrees from the substrate using heating deformation method based on viscous flow in the supercooled liquid region of thin-film metallic glass and the bimetallic effect. Currently, integration on the substrate is being considered for multi-component flow measurement, though achieving three-dimensional structures has been difficult with conventional manual assembly [1]. Thin-film metallic glass is a type of amorphous alloy thin film, which is essentially free from defects resulting from crystalline structures and is an isotropic material. Furthermore, metallic glass exhibits viscous flow in the supercooled liquid region above the glass transition temperature and below the crystallisation temperature [2]. Therefore, this is considered a suitable material for microstructure. In this research, we used $Ni_{57}Nb_{17}Zr_{26}$ as a thin-film metallic glass, which has excellent mechanical properties. Previous studies have shown that it is difficult to obtain a deforming angle of greater than 90 degrees simply by utilizing the viscous flow and gravity of the metallic glass in the supercooled liquid region [1]. Therefore, we aimed to increase the deforming angle by using the bimetallic effect specific to thin-film metallic glass. As shown Figure 1, this bimetallic effect is distinguished from typical bimetallic effect. Once deforming has occurred in the supercooled liquid region and it is cooled, the deformation is fixed and does not deform around room temperature. As seen in Figure2, the authors successfully achieved deformation angles of 107.5 degrees by depositing Au as a bimetallic layer on the hinge of the thin-film metallic glass.

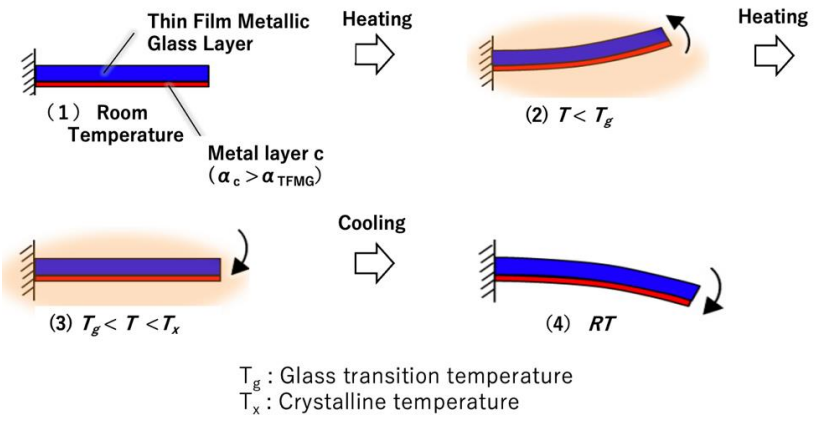

Figure 1: Bimetallic effect of thin-film metallic glass

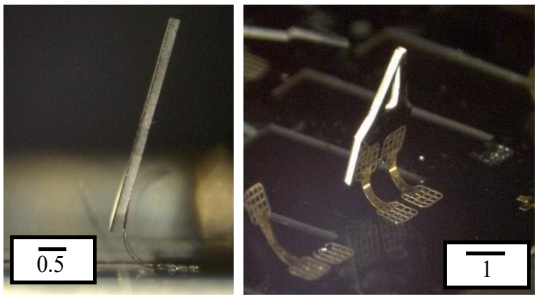

Figure 2: fabricated probe with Au layer

References

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