Mechanical property evaluation of Zr-Ti-Fe thin film metallic glasses

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Abstract

Recently, thin film metallic glass (TFMGs) have drawn lots of attention from academia and industries due to their unique properties and possible applications. In this study, four ternary Zr-Ti-Fe TFMGs were fabricated on Si wafer and AISI304 stainless steel disk substrates using a magnetron co-sputtering system. The power of iron target was adjusted to grow TFMGs with different Fe contents. The effects of iron content on the microstructure and mechanical properties of Zr-Ti-Fe TFMGs were discussion. The thin film metallic glass materials consisted of an amorphous structure, with an absence of any detectable peak corresponding to crystalline phases. The surface morphology of TFMGs showed a very smooth surface by the analysis of atomic force microscopy. The hardness and elastic modulus of TFMGs were analyzed by nanoindentation. Furthermore, the bulge test was carried out to determine the residual stress, elastic modulus and deformation behavior of TFMGs from the pressure–deflection curves. The influence of Fe concentration on the mechanical property and deformation behavior of ternary Zr-Ti-Fe TFMGs was discussed.

Keywords: Zr-Ti-Fe TFMGs, nanoindentation, bulge test, hardness, elastic modulus, residual stress