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Microstructural study of antibacterial Zr-Cu, Zr-Ag and Zr-Cu-Ag thin films

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The controlled synthesis of metallic thin films (TFs) is crucial in many applications. Zr-, Cu- and Ag-based TFs may be suitable candidates for infrared reflector, decorative, antibacterial or electronic applications. In this context, the development of thin film metallic glasses (TFMGs) has also received an active interest due to promising mechanical and physicochemical properties. On the other hand, combinatorial thin film approach has been widely used to study composition-structure-property relationships and to discover new functional materials. Films representing a large chemical composition range are deposited in a single synthesis step, which is particularly convenient for the study of phase diagrams, compared to the traditional one-alloy-at-a-time method.
In the present work, Zr-Cu, Zr-Ag and Zr-Cu-Ag alloy systems are investigated by combinatorial thin film approach using PVD magnetron co-sputtering. Detailed structural, microstructural and chemical investigation is performed using X-ray diffraction, scanning electron microscopy and transmission electron microscopy.
Zr-rich TFs can be described by three distinct structures, depending on pressure and temperature. In this context, the influence of copper content on the formation of hexagonal metastable structure (ω-Zr) is firstly studied. On the other hand, binary Zr-Cu films, deposited by magnetron sputtering, is known to exhibit a glassy-like microstructure in a wide composition range. The Zr-Cu TF microstructure is secondly discussed with regard to deposition parameters, such as oxygen content and sputtering method. Finally, ternary Zr-Cu-Ag TFMGs deposition is investigated in relation to the development of antibacterial coatings.

Keywords
Thin film metallic glasses
Sputtering
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