Mechanical Engineering Thesis Defense

Synthesis and Characterization of sputter deposited Yttrium Zinc thin films

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Abstract

This thesis presents a study on the microstructure and mechanical properties of Yttrium-Zinc (YZn) thin films. Rare-earth intermetallic compounds have gained significant attention in recent years due to their unique structural and mechanical properties, making them suitable for various applications in different fields. However, studies on the Yttrium-Zinc system are scarce and there are very few published reports on YZn thin films. The main objective of this study is to investigate the microstructure and mechanical properties of YZn thin films using various experimental techniques. In this study, we synthesized YZn films of various thickness via magnetron co-sputtering: 200 nm, 500 nm, 1 µm, 2 µm and 11.5 µm. We then annealed these samples at 250°C, 300°C, 350°C and 400°C to investigate their microstructural evolution and mechanical properties. X-ray diffraction (XRD) and scanning electron microscopy (SEM) based techniques have been used to analyze the microstructure and chemical composition of these compounds.

Our results show that the microstructure of YZn thin films is dependent on the annealing conditions. The microstructure of samples deposited at room temperature and those annealed at 250°C and 300°C were found to be amorphous. Annealing at higher temperatures leads to crystallization of the films. Moreover, the results demonstrate that YZn intermetallic thin films have high hardness, which make them suitable for various industrial applications, such as magnetic storage devices, electric motors, and aerospace materials.

This work represents an initial effort to understand the microstructural evolution and mechanical properties of YZn thin films as a function of film thickness and annealing temperatures. The results of this study can be used to guide the design and development of YZn thin films with tailored microstructures and mechanical properties for various applications.

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