

**ADVANCES
IN MATERIALS
ENGINEERING**

Volume 2

**Edited By:
Md Abdul Maleque
Iskandar Idris Yaacob
Zahurin Halim**



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Synthesis and Characterization of Electrodeposited Iron-Platinum Nanostructured Thin Films

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Abstract. A novel stable single bath electrodeposition system was developed to deposit Iron-Platinum (FePt) thin films on brass substrates. Complex-forming additive was added to stabilize the Fe²⁺ ions by forming Fe complexes in aqueous solution to minimize their oxidation. The deposited FePt films at molar ratio of Fe²⁺ to Pt⁴⁺ of 25:25 were found to contain higher Fe content, in proportion with the increasing concentration of complex-forming additive in the electrolyte. However, FePt thin films with higher platinum content were obtained with molar ratio of 200:1 when no complex forming additive was used. The composition of the electrodeposited film was controlled by varying current density, concentration of the substances and complex-forming additive in the electrolyte. The as-synthesized FePt films were then characterized by X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDX) and scanning electron microscopy (SEM). X-ray diffraction characterization showed a disordered face-centered cubic FePt in the as-deposited films while the Fe-rich film exhibited body-centered cubic lattice structure. The average crystallite size of deposited films ranged from 4.3nm to 39nm, showing a minute nano crystal structure.

Introduction

Equiatomic FePt alloy thin films have attracted significant attention for possible high density recording media and high energy permanent magnets because of exceptional magnetic properties [1], high coercive force, good corrosion resistance as well as wear resistance [2]. To achieve the next generation of recording media with an areal density higher than 100Gbit/in² [3], the grain size must be reduced to a few nanometers in diameter [4]. L1₀ ordered FePt phase has a large uniaxial high magnetocrystalline anisotropy energy constant, $K_u \sim 7 \times 10^7$ erg/cm³ and is regarded as the most promising material for future ultra high density recording media [5,6]. In general, annealing at 600°C and above is required for phase transformation from soft magnetic face-centered cubic (fcc) phase, which exists in the as-synthesized FePt film, to hard magnetic L1₀ ordered face-centered tetragonal (fct) phase [2,5].

Numerous physical and chemical methods have been employed to produce FePt alloys including sputtering, metal evaporation, grinding, and liquid phase metal salt reduction [2]. The electrochemical deposition technique has major advantages over other methods with