

Effect of different Sulfur concentration on structural and magnetic properties of electrodeposited NiCoS magnetic thin films

T. Baskar^{1*}, K.S.Rajni²

¹Department of Physics, Karpagam University, Coimbatore-641021, TamilNadu, India

²Department of Sciences-Physics, Amrita Vishwa Vidyapeetham, Coimbatore-641112, TamilNadu, India

Abstract: Nano crystalline NiCoS alloy thin films were deposited on the copper substrate with different concentration of Sulfur by electrodeposition method. Electro deposited NiCoS thin films were subjected to the structural, mechanical and magnetic characterization analysis. The chemical composition of the coated films was analyzed by EDAX. The surface and structural morphology of the coated film were analyzed by using SEM and XRD. The mechanical properties of NiCoS films have been studied by VHT. The magnetic properties of thin films have been analyzed by VSM. The electroplated NiCoS thin films were strongly adherent to the copper substrate. The SEM pictures of NiCoS thin films shows that the deposits of thin films are crack free, uniform and bright surface with fine grain size. All the electro deposited NiCoS films exhibit FCC crystalline structure with crystalline size in the order of nano scale. The VSM result of NiCoS thin films shows that the NiCoS thin films coated with high concentration of sulfur have highest saturation magnetisation value with lower coercivity. Due to highest magnetisation value with low coercivity, NiCoS thin films can be used for the manufacturing of MEMS and NEMS devices.

Keywords : Electrodeposition, thin films, characterization, crystalline size, X-ray diffraction, temperature, surface morphology, micro hardness.

1. Introduction

The most commonly used magnetic materials in MEMS and NEMS are soft magnetic materials, such as nickel cobalt based alloys (1-3). The most significant application of soft magnetic materials is in magnetic recording heads. The important requirement for high quality thin film recording heads are high magnetic saturation, low coercivity, high permeability, near zero magnetostriction, high electrical resistance and good corrosion resistance (4). The combination of low coercivity, relatively high magnetic saturation and good corrosion resistance has led to the use of electroplated NiCo films in microscopic sensors, actuators and systems. The electroplated magnetic thin films of the iron group metals (Ni, Co, Fe) have been developed due to its potential applications in MEMS (5-7).

In the recent years, electrodeposition of ferromagnetic alloys has given much attention as an effective method for the fabrication of micro devices and sensors due to its ability to fill up patterns of high aspect ratio properties as compared with the conventional vacuum deposition techniques such as CVD and PVD (8-12). So the electrodeposition method has been chosen for coating the NiCoS thin films in this current investigation. In