ADVANCES IN MATERIALS ENGINEERING

Volume 2

Edited By:
Md Abdul Maleque
Iskandar Idris Yaacob
Zahurin Halim

IIUM PRESS
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

ADVANCES IN MATERIALS ENGINEERING VOLUME 2

Edited By:
Md Abdul Maleque
Iskandar Idris Yaacob
Zahurin Halim

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Md Abdul Maleque, Iskandar Idris Yaacob & Zahurin Halim: Advances in Materials Engineering

ISBN: 978-967-418-168-0

Member of Majlis Penerbitan Ilmiah Malaysia -- MAPIM
(Malaysian Scholarly Publishing Council)

PRINTED BY:
IIUM PRINTING SDN.BHD.
NO. 1, JALAN INDUSTRI BATU CAVES 1/3
TAMAN PERINDUSTRIAN BATU CAVES
BATU CAVES CENTRE POINT
68100 BATU CAVES
SELANGOR DARUL EHSAN
TEL: +603-6188 1542 / 44 / 45 FAX: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

Table of Content

Chapter 029

Synthesis and Characterization of Electrodeposited Iron-Platinum Nanostructured Thin Films

Seoh Hian Teh[1] and Iskandar I. Yaacob[2]
[1]Faculty of Engineering, University of Malaya
[2]Kulliyyah of Engineering – International Islamic University Malaysia
✉ : iskandar_yaacob@iium.edu.my

Keywords: Iron-Platinum, Electrodeposition, Thin films, Nanostructured, Crystallite.

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 Fe^{2+} ions by forming Fe complexes in aqueous solution to minimize their oxidation. The deposited FePt films at molar ratio of Fe^{2+} to Pt^{4+} 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/in^2 [3], the grain size must be reduced to a few nanometers in diameter [4]. $L1_0$ ordered FePt phase has a large uniaxial high magnetocrystalline anisotropy energy constant, $K_u \sim 7 \times 10^7$ erg/cm^3 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 $L1_0$ 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