CONTEMPORARY METALLIC MATERIALS

Md Abdul Maleque
Iskandar Idris Yaacob
Zahurin Halim

IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

CONTEMPORARY METALLIC MATERIALS

Edited by:

Md Abdul Maleque

Iskandar Idris Yaacob

Zahurin Halim

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

ISBN: 978-967-418-164-2

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

Table of Content

Chapter 011

Influence of Grain Size on Magnetic Properties of Electroplated NiFe Alloy

Yusrini Marita[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: Nickel-Iron, Coercivity, Saturation Magnetization.

Abstract: Nickel-Iron nanocrystalline alloys with different grain sizes were fabricated by electrodeposition technique. In this chapter, influence of the grain size nanocrystalline NiFe deposits on saturation magnetization *Ms* and coercivity, *Hc* was investigated. Alternating gradient magnetometer (AGM) with up to 10 kOe applied magnetic field was used to study the magnetic properties of NiFe film. The results showed that saturation magnetization Ms and coercivity Hc were affected by grain size variation. Increase in grain size increased the saturation magnetization. The largest grain size of 18.6 nm showed the highest Ms of 138 emu/g, while the smallest grain size of 7.2 nm showed Ms of 94 emu/g. Minimum coercivity of 3.847 Oe was observed for sample with 7.2 nm grain sizes. The coercivities decreased for smaller grain sizes.

Introduction

Polycrystalline solids with grain size of less than 100 nm are called nanocrystalline materials. Nanocrystalline structures offer a new opportunity to improve current magnetic materials. The properties of nanocrystalline materials are very often superior to those of conventional polycrystalline coarse grain materials. Many synthesis techniques for the production of nanostructured materials have been developed. Examples are gas-condensation, ball milling, so-gel technique, sputtering, and electrochemical deposition [1]. Electroplating offers several advantages as a process for magnetic-material deposition. Films can be electroplated with excellent magnetic properties and plating cells are relatively inexpensive.

Recently, much attention has been paid to the study of nanocrystalline nickel – iron alloys due to their interesting mechanical and magnetic properties [2, 3]. Conventional NiFe alloys are important soft magnetic materials, which have been widely used in industry as recording heads. The NiFe alloy has been particularly emphasized because of its high permeability, low coercivity and relatively high saturation magnetization.

Coercivity is a factor that describes how hard or soft a magnet is. The exact definition of coercivity is the applied field needed to reverse a magnetization. A hard magnet has a high coercivity, and when hysterisis analysis is run, a loop is visible. Low coercivity corresponds to a soft magnet. The saturation magnetization occurs when all the magnetic moments are aligned uniformly and magnetization is at its maximum.