SYNTHESIS AND CHARACTERIZATION OF NiFeMo ALLOY

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A thesis submitted in partial fulfillment of the requirements for the award of Bachelor Engineering (Hons) (Mechanical)

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MAY 2010

ACKNOWLEDGEMENT

I would like to express my sincere and grateful gratitude to my supervisor, Dr Koay Mei Hyie and co-supervisor Puan Norleha Abdul Rahman for their unending support to help me complete this project. I would also like to thank my parents for also lending me their support and helping out with the finance in completing this project. I would also like to thank the lab technician, especially Encik Rahimi, Encik Hairi, and Encik Azrol for assisting me to complete this project. They had to come on their days off to help me. Without their aid and assistance this project would have not been completed. I would also like to thank my friends for helping me in any way possible. Without the help of all the individuals mentioned above, the completion of this project would have not been possible. I really, truly appreciate the support and patience that all had to endure. May the good deeds come back to you and may God bless all of them. THANK YOU!

ABSTRACT

Properties of the Nickel based alloy are high permeability, low coercivity and high saturation magnetization. Molybdenum (Mo) was found to have a strong effect on the crystallization behavior. With the addition of molybdenum to nickel-iron (NiFe) alloys, it exhibit high relative permeability and low eddy current losses. The addition of molybdenum cannot exceed a certain weight ratio for optimum behavior properties. NiFeMo has already been playing its role in the gas turbine engines in aircraft, marine, industrial and vehicular gas turbines. Now, researches are being carried out to optimize the properties for this alloy to be applied to other high industrial application such as space vehicles, rocket engines, experimental aircraft, nuclear reactors, and other high-temperature applications. The effects of molybdenum addition to the microstructure of NiFeMo alloy are investigated in this study. The maximum weight ratio for Mo is set at 5%. Samples consisting of 30Ni-70Fe, 30Ni-69Fe-1Mo, 30Ni-67Fe-3Mo, and 30Ni-65Fe-1 wt% are made. This experiment involved synthesizing intermetallic in mechanical alloying, compacting the milled powders into pellet by isostatic pressing, and annealing in a furnace. Zirconia jar and balls were used for mechanical alloying with a rotation speed of 200 rpm that are milled for four hours for each sample. Compaction process involved compacting the samples into cylindrical pellets under a pressure of 400 kg/cm^2 and maintained for 10 minutes. Annealing took place in a furnace under a temperature of 600°C for one hour. Samples before and after annealing are made to be tested under optical microscope, XRD, and LCR meter. From the XRD test, four phases exist, which are nickel (Ni), iron (Fe), iron diiron(III) oxide (Fe_3O_4), and kamacite (NiFe). From the same test, crystallite sizes are found to be less than 20

nm. Addition of 3% Mo shows the highest for the hardness test. As addition of Mo increases, the resistivity of the material decreases. This shows that the addition of Mo is favourable for NiFe application.

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