APPROVAL

DETERMINATION OF THE VARIATION OF NITROGEN PRESSURE ON THE SURFACE HARDNESS OBTAINED BY NITRIDING STEEL IN PLASMA FOCUS DEVICE

by

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DECLARATION

I, the undersigned, hereby declare that this report is my own independent work except as specified in the references and acknowledgements. I have not committed plagiarism in the accomplishment of this work, nor have I falsified and/or invented the data in my work. I am aware of the University regulations on Plagiarism. I accept the academic penalties that may be imposed for any violation.

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ABSTRACT

A 3kJ Mather-type plasma focus device used to carry out plasma nitriding on the surface of AISI 1020 carbon steel. The nitriding process was carried out under different nitrogen gas pressure (0.5, 1.0, 1.5 and 2.0 Torr) and different axial distance of steel from anode tip (40, 60, 80, 100, 120mm). The surface hardness and surface morphology of the nitrided steel were studied through the observation by using Vickers hardness tester and optical microscopy respectively. Lee Model Code was used to measure the dynamic of ion beam emitted by plasma focus device to identify the parameters of ion beam, in term of ion beam energy, ion current and number of ion per shot. The results of ion beam parameters were correlated with the surface hardness of nitrided steel to study their relationships. Efficient nitriding occurred at the operation with 1.0 Torr of nitrogen gas which the steel was placed 40mm above anode tip. A thin non-homogenous layer of shiny white colour iron nitrided with 10~30mm diameter was formed on the surface of nitrided steel which indicated the sputtering of steel cause by fast ion beam. The highest average surface hardness at epicenter was found to be 389.5 HV 0.2 with 125.5% of increment than its original value for the steel that treated with 1.0 Torr of nitrogen gas which the steel was placed 40mm above anode tip. Due to the fluctuation of the value of surface hardness, the average for highest surface hardness was calculated and found to be 404.8 HV 0.2 with 134.4% of increment for the same sample. The correlation by using Lee Model Code showed that ion beam energy and ion current had their peak value with 16.51J and 27.5kA respectively at the sample with highest surface hardness. The highest number of ions per shot occurred at the nitriding with 1.5 Torr nitrogen gas at 40mm axially above the anode tip.

Keywords: **Mather-type plasma focus device, Plasma nitriding, Vickers hardness test, Iron nitride thin film, Lee Model Code**

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DEDICATION

This thesis is dedicated to those who have the passion to carry out research in plasma focus and my family who always supported to complete my dream.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AFM	Atomic Force Microscope
EDX	Energy-Dispersive X-ray Spectroscopy
DPF	Dense Plasma Focus
PF	Plasma Focus
REB	Relativistic Electrons Beam
SEM	Scanning Electron Microscopy
SOP	Standard Operating Procedure
UNU/ICTP PFF	United Nation University/International Center for Theoretical Physics Plasma Focus Facility
XRD	X-ray Diffraction