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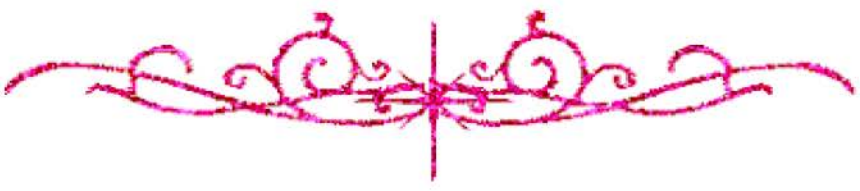

بالرسالة صفحات لم ترد بالأصل

THE USE OF SOLID STATE NUCLEAR TRACK DETECTOR IN RADIATION DOSIMETRY

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THESIS
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BY

Emad Hamed Mohamed Ghanim
B. Sc. (Physics)

SUPERVISED BY

Prof. Dr. M. K. El-Nimr
Professor Of Physics
(Tanta University)

Prof. Dr. A. A. Hussein
Assist. Prof. Of Physics
(Menoufia University)

Dr. S. A. Hager
Lecturer of Physics
(Menoufia University)

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‹God›... Thought Man What He Did Not Know.

[HOLY QUR'AN]

"To My Close Family"

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CONTENTS

SUMMARY

SUMMARY

Etched nuclear track plastic detector are being widely nowadays in a variety of application through the field of radiation dosimetry due to their several advantages; namely: excellent properties of data analysis, high registration sensitivity ..., etc. Throughout this work, CR-39 and Lexan nuclear track detectors were used. Various treatments of chemical (CE) and electrochemical (ECE) etching were performed. Prechemical etching technique (PCE) was applied and proved to be useful in minimizing the background in such detectors and optimal conditions were found.

The main task of this work was to construct a sinusoidal high-voltage, high-frequency power supply in our laboratory for the use in electrochemical etching development of heavy ionized and recoil particle tracks in polymeric detectors. The present system consists namely of power amplifier, high-voltage transformer, high-voltage measuring unit and ECE cell.

The system operates well over a wide range of frequencies, from 0.5 up to 10 kHz with maximum peak-to-peak output voltage of about 8.0 kV. ECE characteristics and physicochemical optimization conditions of ECE parameters were obtained

to achieve maximum detection efficiency of the plastic recorders used.

Detection efficiency values and sensitivity parameter of the studied plastic foils were determined, for heavy ionized particles as well as for fast-neutron-recoils, under different chemical and electrical conditions. Particles tracks development, low activity alphas and fast neutron dosimetric measurements were performed and discussed in the framework of track formation criteria in the nuclear track plastic detectors.

This thesis contains five chapters, conclusion and references.

Chapter one is an introduction which includes a survey on the advantages of solid state nuclear track detectors (SSNTDs) and their usages. Also, this chapter includes some historical reviews about such detectors, notes about track forming mechanism, radiation units and finally the aim of this work.

Chapter two contains the interaction of heavy ionized particles and uncharged beams of fast neutrons with matter. A survey on the various sources of neutrons and their energy spectra is also included in this chapter. The track forming criteria is included where a representation about total energy loss, REL, primary ionization and RREL can be found.

Chapter three discusses, in details, the chemical and electrochemical etching methodologies as the operating techniques in development particle tracks. In this chapter the various parameters that affecting the chemical and electrochemical etchability are included.

The development and construction of an ECE high-voltage, high-frequency power supply for electrochemical track etching are given in chapter four. Specifications of ECE system;power amplifier, high voltage transformer and EHV measuring unit are contained. Also, in this chapter a special design of ECE cell is given. Among the framework of this chapter, the characteristics of the electronic homemade circuit and optimization conditions of ECE parameters are included in order to achieve maximum detection efficiency of the plastic recorders used in this study.

The application part of this thesis is given in chapter five. It contains a physicochemical studies of some nuclear track plastic recorders using various chemical and electrochemical etching conditions. Also, the use of chemical and electrochemical etching procedures in particle track identification and dosimetric applications is included; where alpha particles and fast neutrons are used.