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CHARACTERISTICS OF THE CRS FAST NEUTRON PERSONAL DOSEMETER

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ABSTRACT

A fast neutron personal dosemeter based on the two-step electrochemically etched CR-39 detectors has been developed by the "Centre de Radioprotection et de Sûreté" (CRS), in as simple a form as possible to be used in routine monitoring of neutron irradiated workers in Algeria.

This paper presents the dosimetric characteristics of the developed dosemeter such as energy and angle dependence, dose equivalent response and low limit of detection which are much improved compared to our previous work. The obtained energy response is both flatter (±25%) and extended to lower energy (≈25 keV). Also, a lower detection limit of about 90 μSv has been achieved. In addition, the evaluation of the energy response in term of track size distributions has been performed.

KEYWORDS

Neutron personal dosemeter; CR-39; two-step electrochemical etching; track-size distributions.

INTRODUCTION

Despite of some thirty years of investigations, personal neutron dosimetry remains a great problem in radiation protection field. The performance of presently available neutron personal dosemeters are far from ideal. Among neutron personal dosemeter used today, etched track detectors have been considered as one of the most promising detectors since the introduction of CR-39 plastics (Cartwright, 1978). The main advantage of the CR-39 dosemeter is its insensitivity to photon irradiation and its low neutron energy threshold. Also, this dosemeter does not have severe energy dependence that exists with albedo dosemeters and suffers less from fading and environmental effects than NTA films. Even though some of other detectors under investigations (bubble detector (Francesco, 1995) and electronic dosemeter (Barthe *et al.*, 1995)) may offer advantages in sensitivity, angle and energy dependence of the response, CR-39 dosemeter remains the cheap and versatile neutron dosemeter with a wide range response in term of neutron energies.

The results of investigations of these last years have shown that electrochemical etching (ECE) technique improves the dosimetric proprieties of CR-39 dosemeter (Tommasino *et al.*, 1984). The ECE increases the track diameter and make counting easy. In particular, the two-step ECE technique offers the most advantages such as higher sensitivity for broad energy range compared to either conventional chemical etching or single frequency electrochemical etching procedure (Djeffal *et al.*, 1996). This ECE technique can be optimised with criteria of extending the lower energy range and reducing the lower detection limit by varying the ECE parameters (Piesch *et al.*,1991).