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Track etch parameters in CR-39 detectors for proton and alpha particles of different energies

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Abstract

Etchable track formation in poly-allyl-diglycol carbonate (commercially known as CR-39) track detectors is a process directly related to density of damage produced along the charged particle path; it requires knowledge of the variation of bulk etch rate V_b and track etch rate V_t as a function of the initial particle energy and etching time. In this paper, the track etch parameters have been experimentally measured in CR-39 detectors irradiated with proton and alpha particles in the energy ranges 0.5–2.5 MeV and 1–5.8 MeV, respectively. Detectors were chemically etched in a hot hydroxide potassium solution for periods ranging from 1 to 32 h. The dependence of track diameters on the energy values, the correlation between the maximum track diameter and the Bragg peak and the variation of the track etch rate V_t as a function of the incident particle energy for different etching times are presented and discussed. Critical values of detection angles and optimal energies of the incident protons on the CR-39 have been deduced. The present results are compared with those given in recently published works. © 2001 Published by Elsevier Science B.V.

Keywords: Poly-allyl-diglycol carbonate (CR-39); Bulk etch rate; Track etch rate; Bragg peak; Restricted energy loss; Critical angle of incidence

1. Introduction

Damage track detectors are extensively applied for the assessment of low concentrations of alpha emitting radio-nuclides in radon dosimetry and for measurements of recoil particles in neutron dosimetry [1,2]. They became especially attractive when the poly-allyl-diglycol carbonate (commercially known as CR-39) detectors were introduced into practical dosimetry use because of their low linear energy transfer (LET) threshold for detecting recoil protons and other charged particles [3].

Our team has dedicated much effort to study the physical characteristics of these detectors with respect to their possible use in radiation dosimetry with the aim of low minimum detectable dose, good linearity and acceptable reproducibility [4–6].

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