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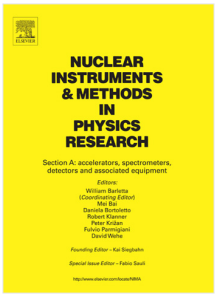

CR-39 nuclear track detector: An experimental guide

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CR-39 nuclear track detector: An experimental guide

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Abstract

The influence of preservation period of CR-39 detectors, in refrigerator and in the laboratory atmosphere, on bulk etch rate is studied. The effect of etching solution usage time on the bulk etch rate is also investigated. Analyses and quantitative results in the said cases are presented. Finally, precision results on the use of CR-39 as a charged particle detector are presented in a systematic manner. These results are selected from our radiation detection and measurement experiments, ranged over last two decades. Selected results (unpublished and published) include CR-39 measurements of 5.9 MeV antiprotons, 6.12 MeV alpha particles and spontaneous fission fragments of ^{252}Cf. Our published results, presented here, are further analyzed and presented in comparison with new results and discussion. Experimental procedures of exposures, chemical etching, track measurements using the optical microscopy are described, keeping in view the new users and research students. Computer codes TRACK_Vision and SRIM were employed to provide a comparison with measurements of track parameters, where possible.

Keyword: Antiprotons; Alpha particles and Fission fragments; CR-39; Chemical etching; Microscopic examination; Radiation detection and measurement; Standardization

1. Introduction

CR-39 is a highly sensitive charged particle detector in the present paradigm of solid state nuclear track detectors (SSNTDs). Details about the discovery and sensitivity of CR-39 detector are present in a number of previous studies [1-6]. It has been employed to study nuclear fission, high energy nuclear fragmentation, fusion plasmas, cosmic-rays including rare particles like magnetic monopole, radon measurement and fabrication of nanostructures [7-17]. Fig. 1 is about recent use of CR-39 in R&D. It shows the number of publications with words “SSNTDs” and “CR-39” appearing in title, abstract and keywords fields of articles published from 2008 to 2017. The database Scopus was used for the investigation presented in Fig. 1. Scopus is the abstract and citation database of peer-reviewed literature