

Development of Alpha Spectroscopy Method with Solid State Nuclear Track Detector Using Aluminium Thin Films

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Abstract : This work presents the development of alpha spectroscopy method with Solid-state nuclear track detectors using aluminum thin films. The resolution of this method is high, and it is able to discriminate between alpha particles at different incident energy. It can measure the exact number of alpha particles at specific energy without needing a calibration of alpha track diameter versus alpha energy. This method was tested by using Cf-252 alpha standard source at energies 5.11 MeV, 3.86 MeV and 2.7 MeV, which produced by the variation of detector -standard source distance. On front side, two detectors were covered with two Aluminum thin films and the third detector was kept uncovered. The thickness of Aluminum thin films was selected carefully (using SRIM 2013) such that one of the films will block the lower two alpha particles (3.86 MeV and 2.7 MeV) and the alpha particles at higher energy (5.11 MeV) can penetrate the film and reach the detector's surface. The second thin film will block alpha particles at lower energy of 2.7 MeV and allow alpha particles at higher two energies (5.11 MeV and 3.86 MeV) to penetrate and produce tracks. For uncovered detector, alpha particles at three different energies can produce tracks on it. For quality assurance and accuracy, the detectors were mounted on thick enough copper substrates to block exposure from the backside. The tracks on the first detector are due to alpha particles at energy of 5.11 MeV. The difference between the tracks number on the first detector and the tracks number on the second detector is due to alpha particles at energy of 3.8 MeV. Finally, by subtracting the tracks number on the second detector from the tracks number on the third detector (uncovered), we can find the tracks number due to alpha particles at energy 2.7 MeV. After knowing the efficiency calibration factor, we can exactly calculate the activity of standard source.

Keywords : aluminium thin film, alpha particles, copper substrate, CR-39 detector

Conference Title : ICMPPR 2016 : International Conference on Medical Physics, Radiation Protection and Radiobiology

Conference Location : Zurich, Switzerland

Conference Dates : January 12-13, 2016