Fast neutron dose response of a commercial polycarbonate

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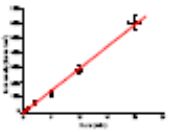
Few Brazilian workers that are exposed to neutron sources are monitored to fast neutrons due to the costs of detectors' materials that are imported. To solve this problem the Radiation Metrology Center (CRM) of IPEN is studying a commercial polycarbonate produced in Brazil to replace the well-known neutron detector materials as Makrofol and CR-39 on Solid State Nuclear Track Detection (SSNTD) [1,2]. This technique is based on the damage (tracks) registration of charged particles produced by the interaction of neutrons with carbon and oxygen atoms of some dielectric materials. The tracks are revealed and amplified for visualization in an optic microscope through a technique knows as chemical etching [3].

The dosimeter prototype is composed of a 30 x 10 x 1,5 mm^3 polycarbonate sample placed between two acrylic plates 2 mm thick. These acrylic plates contribute to shield the polycarbonate to alpha particle that affects the response.

The prototypes were irradiated at the Neutrons Laboratory of the National Laboratory of Ionizing Radiation Metrology (LN/LNMRI) with an isotropic ^{241}AmBe source, in air, on an ISO slab phantom. To study the dose response groups of five prototypes were irradiated with Hp(10) from 0.5 mSv to 20 mSV with normal incidence and to investigate the angular incidence effect groups of two prototypes were irradiated with Hp(10) 2 mSv with incidence angles of 15°, 45°, 60° and 75°.

The detectors were revealed by chemical etching with the solution PEW-40 (15% KOH, 45% H_2O, 40% C_2H_5OH) during 3 hours. The track density of the detector surface is determined by the average of track counting of five fields (20 x 0,1 mm^2).

The track response to equivalent dose Hp(10) shown a good agreement with linear fit in the studied interval. The track density strongly decreases for incidence angles higher than 45°. In spite of presenting a linear behavior for personal dosimetry, the polycarbonate response should be correct for directional dependence.



References

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