Miniature Proportional Counter Microdosimetry Measurements in Clinical BNCT Beams

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Interpretation of the macroscopic absorbed dose in BNCT is difficult due to variations in RBE within the beam and due to the microscopic ranges of the products of the boron neutron capture reaction. Proportional counter microdosimetry addresses these problems by providing the single event spectrum of charged particles depositing the absorbed dose in a simulated microscopic site in tissue. A dual tissue-equivalent proportional counter (TEPC) system has been developed utilizing miniature TEPCs, thus permitting measurements in high flux epithermal neutron beams. Loading one of the TEPCs with 200 μg/g ^{10}B allows the boron neutron capture dose to be obtained through subtraction of the two spectra. This dual counter technique facilitates an assessment of the RBE based on the shape of the charged particle spectrum, as well as a direct determination of the boron neutron capture dose in a subcellular site. Measurements have been made at the MITR-II reactor at the Massachusetts Institute of Technology and the BMRR reactor at the Brookhaven National Laboratory. TEPC measured gamma and neutron doses show good agreement with conventional macrodosimetry methods. However, boron neutron capture doses from TEPC measurements differ significantly from those calculated from foil activation measurements. This work was supported in part by the U.S. Department of Energy, grant # DE-FG02-96ER62217.