MEASUREMENT OF DOSE DISTRIBUTIONS IN LET PRODUCED IN MATTER BY FAST NEUTRON IRRADIATION (KERMAFACTOR)

Michael Charles Schell

A detector has been developed and used to measure the dose distributions vs. LET in thin gas targets is spherical geometry from fast neutron irradiation of tissue equivalent plastic and carbon. These data are a physical characterization of the fast neutron interactions with the detector wall material and provide the physical basis for material damage studies in fusion technology. The LET Detector could measure charged particle types and make available data for the predictions of radiobiological effect with the Track Structure Model of Katz.

The detector is a hemispherical proportional counter with an inorganic scintillator at the center of the hemisphere. The coincidence of the proportional counter and scintillator signals constrain the measurements to the charged particles traversing only the radius of the hemispherical proportional counter. The charged particle energy deposition distributions are directly measured for a known pathlength.

The measured charged particle energy loss distributions are compared with theoretical linear energy transfer spectra and both measured and calculated event size distributions. The kerma in the wall material from fast neutron irradiation is inferred from the dose in the gas by means of the Bragg-Gray cavity theory. The measured kerma in carbon and A-150 plastic from fast neutron bombardment are compared with the calculated kerma based on microscopic cross sections.