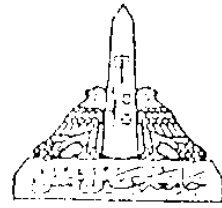


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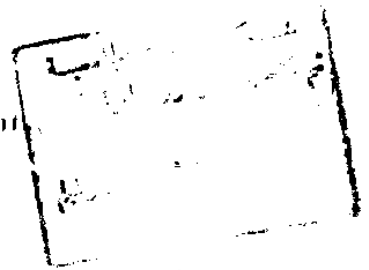
**Neutron and Gamma Spectra Leaking
Through Shielding Materials**



Submitted to the Physics Department

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For

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ABSTRACT

The aim of the work is to investigate the attenuation properties of steel, graphite, ilmenite concrete, ordinary concrete and hematite-serpentine concrete to fast neutrons and gamma-rays.

These materials are widely used for constructing shields for nuclear reactors and other radiation sources.

SUMMARY

In this work, experimental studies were performed to assess the attenuation properties of some materials widely used in reactor technology for neutrons and gamma-rays. The investigated materials includes steel, graphite, ilmenite concrete, ordinary concrete and hematite-serpentine concrete. Studies were carried out for homogeneous shields of spherical geometry made of steel and graphite with Pu- α -Be neutron source placed at their geometrical central point. Also, a collimated beam of reactor neutrons and gamma-rays was used to study the leakage fast neutron and gamma-spectra behind cylindrical barriers having different thicknesses of graphite and different types of concrete. Further, the effect of exposing samples of ordinary and hematite-serpentine concretes to different temperatures on the attenuation of neutrons and gamma-rays was studied using the emitted reactor beam.

Measurements of the leakage fast neutron and gamma spectra have been carried-out with a neutron - gamma - spectrometer with a stilbene scintillator coupled to 12 stage photomultiplier tube type EMI. Discrimination between undesired pulses of recoil electrons and recoil protons was achieved with a zero cross over method based on pulse shape discrimination technique. The spectrometer linearity, energy scaling and discrimination capability were checked with neutron and gamma-rays emitted from standard sources of Pu- α -Be, ^{22}Na , ^{137}Cs and ^{60}Co . The spectrometer energy scaling and stability were checked before and after each measurement by measuring pulse amplitude distribution emitted from standard ^{22}Na source. The obtained energy scaling was used for converting the measured pulse amplitude

distribution to neutron or gamma-energy distributions by the unfolding codes given and discussed in this work.

The measured spectra of fast neutrons and gamma-rays were normalized to the same measuring time and presented in the form of displayed spectra which show the relation between fluxes of neutrons or gamma-rays versus energies of neutrons or gamma-rays.

The given spectra of fast neutrons and gamma-rays were used to plot groups of attenuation relations which show the fluxes of neutrons or gamma-rays versus shield thickness in cm. The attenuation relations were used to derive the neutron total macroscopic cross-sections and total gamma-rays linear attenuation coefficients for different energies of neutrons and gamma-rays.

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