Effect of the Scattered Neutrons in Radiography Sensitivity

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Abstract

The image quality in neutron radiography(NR) is directly affected by scattered neutrons which are usually generated in the sample, shielding and others surrouding materials near the irradiation position. This paper invisages to quantify, for the present (NR) facility, the effect of the scattered neutrons by the sample, in the technique sensitivity concerning its capability for thickness discern. The facility is installed at the BH-8 of the pool type 2 MW IEA-R1 nuclear reseach reactor and the neutron beam impinging the sample has a flux of about $3x10^6$n/s.cm^2, diameter 20cm, n/γ>$5x10^5$n/cm^2.mrem and is filtered by a policrystalline bismuth 20cm thick. The radiographs were obtained by the direct method with gadolinium screen. The samples in the form of slices(2mm thick), were placed outside an aluminum cassette near the converter-film image system. The technique sensitivity was calculated by the equation $\Delta x=\Delta D/(Dop.\Sigma tot)(1)$ where ΔD is the intrinsic error of the optical densitometer, Dop is the optical density reading as a function of the material thickness($0<t<12$mm) and Σtot is the experimentally determined effective total macroscopic cross section. Several samples such as perspex, cooper, iron, cadmium with different scattering to non-scatterring cross sections ratios were selected.

In order to evaluate such contribution these results were compared with those obtained from equation(1) taking into account theoretical values for Σtot considering the scattering component neglected. The discrepances in sensitivity ranged from 20 to 50%.