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Feasibility of Fast Neutron Radiography in Weapon Quality Detection

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Abstract: In order to study the feasibility of fast neutron radiography technology (FNR) in weapon quality detection, the research object was established on the basis of the open hypothetical weapon model, and the MC method was used to evaluate the safety of the fast neutron radiography in the weapon quality detection. Results showed that the fissile materials of uranium and plutonium have minimal damage under 14.1 MeV fast neutron irradiation with a total dose of 2×10^8n. On the basis of referring to the foreign research model and the default defects, the author designed and manufactured the experimental samples, and studied the internal slit, round hole and center displacement which may appear in the weapon inspection by means of both experiments and simulations. The experiment results show that FNR can identify the defects of 1-mm-thick slits inside a steel block of 5 mm thickness. The simulations further show that FNR is able to diagnose the center displacement with certain thicknesses for particular materials. Therefore, our results suggest FNR could be a feasible and potential technique in weapon quality testing.
Key words: fast neutron radiography (FNR); quality inspection safety evaluation; feasibility study; monte carlo (MC) method
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