Comparative study between conventional and digital neutron radiography

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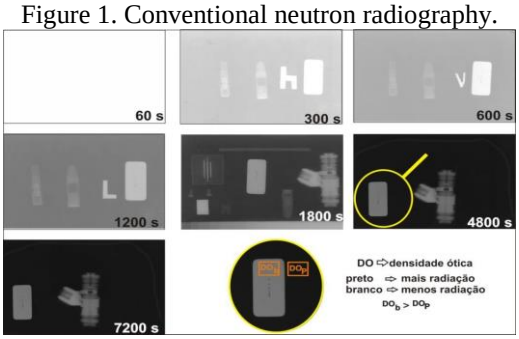
This study presents two methods used to record the neutron radiography images: conventional and digital. The first uses film, while the latter uses image plate screens that also provide good resolution and high sensitivity. This project compares the two techniques, specifying the thickness variations of a given material (sensitivity) and establishing the shortest distance separating two objects in a way that can be distinguished (resolution). These indicators will be able to establish the advantages of each method from the expected results for each non-destructive test (END) technique. Besides that, the doses from the experiments using the Monte Carlo N Particle Extended (MCNP-X) mathematical code will be calculated. In the development of this work will be used the neutron-ray arrangement installed in the irradiation channel J-9 of the Argonauta reactor of the Instituto de Energia Nuclear (IEN) together with the development laboratories of films and screens of image plate. Neutron radiography is an (END) technique that is able to "visualize" the interior of a sample and is based on the principle of attenuation of a neutron beam passing through matter, depending on the material and the geometry of the sample. A basic experimental neutron-based arrangement consists of a neutron source, a collimator, the object to be inspected, and a plane detector. The object is positioned between the collimator output and the detector, which registers a two-dimensional image [1]. The purpose of this test is to observe mass discontinuity, variations in thickness and morphology. END is an essential tool when an equipment, device or component can not be subjected to destructive or invasive procedures due to safety reasons, high cost or other physical or logistical restriction [2]. The Figure 1 shows conventional neutron radiography with radiographic film KODAK – M100 in different exposure times.

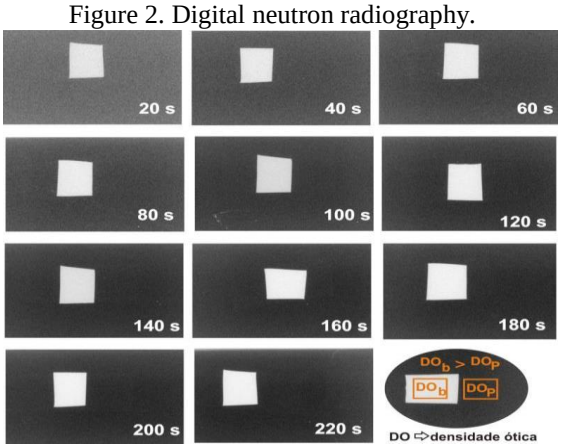
Figure 1. Conventional neutron radiography.



Source: SOUZA, 2012, p.98.

The Figure 2 shows digital nêutron radiography (Fuji Film) in different exposure times.

Figure 2. Digital neutron radiography.



Source: SOUZA, 2012, p.98.

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