

A review of radiation-induced displacement on different generations of reactors by a reactor gamma spectrum

Abstract

High-energy gamma rays emitted from the nuclear reactor's core induce displacement damage in the reactor pressure vessel (RPV). This damage can lead to changes in the mechanical and physical properties of the vessel which potentially causes defects formation. The significance of weakening and brittleness of the RPV as a result of gamma-induced damage should not be neglected. However, recent analyses reveal that in certain reactor configurations, the gamma flux affecting the RPV is substantial enough to significantly contribute to displacement damage. Neglecting this factor would result in inaccuracies in prediction of reactor events. Notably, gamma rays have been linked to accelerated RPV damage. The impact of γ -ray-induced displacement per atom (DPA) can be more significant than that of induced by neutrons in high flux isotope reactor (HFIR) control. Moreover, it has been observed in heavy water reactors that the effect of gamma radiation damage is equally significant as that of neutrons. In this study, the damage caused by the gamma spectrum of reactors in different generations of reactors is investigated. We aim to identify whether gamma radiation damage is considerably affected by the kind of reactors that will be discussed in our next simulation studies using GAMMATRACK code.

Section

Applications of nuclear methods in science, technology, medicine and radioecology

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