RESEARCH ARTICLE

Influence of neutron decay on nuclear reactor materials [version 1; peer review: 2 approved, 1 approved with reservations]

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Abstract

While many of the leading factors for material degradation in irradiated reactor components have been identified through past studies, spontaneous neutron decay within components is a factor absent in the literature. The byproducts of neutron decay, largely composed of a proton, could lead to excessive hydrogen content, irradiation assisted stress corrosion cracking, epsilon martensite formation, hydrides, ion induced damage, voids, bubbles, and dislocation loops. Neutrons are the most abundant relevant fission product, and neutrons are continuously decaying at a rate proportional to their production. This paper hypothesizes that at high neutron fluence, a quantifiable contribution to material degradation can be associated with the proton byproducts of neutron decay. Literature-based degradation mechanisms are presented along with initial calculations of the neutron decay contribution. The paper will demonstrate a potential new factor for consideration in the material degradation of nuclear reactor components.

Keywords

Radiated Materials, Neutron Decay, Hydrogen Embrittlement, Nuclear Reactor

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Approval Status ? ✓ ✓

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