

Radiation Effects on Nuclear Ceramics

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Candidacy Exam

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Abstract

Nuclear Power has been around for decades, and provides 14% of the world's electricity. Materials must be able to withstand extreme and harsh environments for long periods of time to be considered for reactor components. Ceramics are often used for their corrosion resistance and high temperature stability. However, the effect of neutron radiation on material properties is important to consider. The fission reaction process will be described. The theory of irradiation defects and dislocation loops will be discussed. The effect of irradiation on SiC and graphite will be presented, with a focus on engineering properties and dimensional stability. A comparison of material fabrication and purity will also be examined. Future reactor generations call for materials that can withstand more extreme environments, including exotic coolants and higher operating temperatures, while still maintaining properties under irradiation. Advances in radiation-tolerant ceramics will also be presented.