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Review of the radiation effect on the cladding of zirconium alloy in nuclear reactors

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In a nuclear reactor, one of the most important parts is the cladding, which is used to cover the fuel rod. The cladding will face many factors that impact the mechanical structure of the materials while in operation due to its position between the reactor coolant and the nuclear fuel. This cladding should be made of highly corrosion-resistant material with low thermal neutron absorbance.
The zirconium alloy is the preferred material for use as cladding in nuclear reactors. As previously stated, the zirconium alloy is highly corrosion-resistant, and a thermal neutron absorption cross-section is estimated to be 0.18 x 10-24 cm2. In the reactors, we are concerned with three types of zirconium alloys: Zr-Sn-Fe-Ni-Cr alloy (Zircaloy 2), Zr-Sn-Fe-Cr alloy (Zircaloy 4), and Zr-Sn-NbFe-Cr alloy (Zircaloy 2.5).
This material is exposed to pressure from coolant, temperature, and the irradiation process; as well as changes in the crystallization in the microstructure of the alloy. Thus, the zirconium alloy was found to achieve the purpose.
The article reviews the radiation effect on zirconium alloys in nuclear power plants and emphasizes the impact of radiation on the material's mechanical structure. It also explains some phenomena that occur within the cladding during reactor operation and impact the material's quality and life span.

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