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Radionuclide containing solid phases on the inner surface of a Zircaloy-4 cladding tube

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Zircaloy claddings of fuel rods for nuclear reactors are considered as first technical barrier for retention of radionuclides produced in the nuclear fuel. The integrity of the cladding is influenced by various processes during reactor operation and beyond, e.g. oxidation, hydrogen uptake, PCI, fission product precipitation, ⍰-decay, and radiation damage. Composition of agglomerates found on the inner surface of the plenum section of an irradiated Zircaloy-4 cladding tube are investigated by SEM-EDX, XPS, and synchrotron based techniques.
µ-XRF investigations show uranium hot spots and fission products. Grooves from cladding tube production contain uranium residues from fuel pellets insertion. Plutonium, cesium and rubidium are present ibidem. Another type of agglomerates contains cesium, rubidium, and minor amounts of actinides. Cesium and rubidium may originate from three sources: uranium traces within the cladding, uranium residues in surface grooves, and Cs/Rb released from subjacent fuel pellets.

Summary

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