Behaviour of used nuclear fuel : oxidation of irradiated and non-irradiated UO2.

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Abstract

In the framework of the interim storage of used nuclear fuel the main risk to be addressed in safety studies deals with the oxidation of the nuclear ceramic in contact with air due to a defect in the cladding. The oxidation of the uranium dioxide leads indeed to a relative increase of more than 30% of the molar volume when forming U3O8. In order to better predict the evolution of the defected fuel rod, oxidation studies were performed on non-irradiated UO2 powder and irradiated UO2 fragments. In this paper, the obtained results are presented and compared. It will be shown that, with non-irradiated powders, the oxidation proceeds in three stages and not two as previously proposed in literature. This conclusion is justified with X-ray diffraction results using synchrotron radiation. With irradiated fragments, a similar conclusion is drawn thanks to EMPA measurements. Anyhow the quite similar weight gain curves obtained with non irradiated powders and irradiated fragments must not hide different oxidation kinetics.