

Characterisation of uranium vacancies in stoichiometric and hyper stoichiometric uranium dioxide

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Abstract

The properties of the uranium dioxide are very sensitive to stoichiometry. For example creep and sintering, which have important industrial applications, are largely modified by a small change of the concentration of point defects on the cationic sublattice due to variations in the departure from stoichiometry. Up to now, little experimental information is available on point defects of the uranium sublattice in UO_{2+x} . In this paper, the concentration of uranium vacancies in UO_{2+x} is determined as a function of the oxygen partial pressure by an original experiment. A UO_2 single crystal was put in a dilatometer and its length changes were measured as function of the oxygen partial pressure. The evolution of the UO_2 unit cell parameter as a function of the stoichiometry is known from X-Ray data already reported in the literature. The knowledge of this parameter allows to determine the number of cation vacancies from the length change as a function of the oxygen partial pressure, at constant temperature. This result can be introduced in a suitable model to describe the influence of oxygen partial pressure on the properties of uranium dioxide.