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# Unravelling the influences on induction time for uranium hydriding: The influence of oxide thickness

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Induction times for massive uranium-hydrogen reactions are thought to be influenced by at least two significant factors, 1) the presence of small molecule impurities (e.g. $O_2$, $H_2O$) both in the gas phase and adsorbed on or incorporated in the surface oxide over-layer, and 2) the presence of the oxide over-layer itself which is thought by many to hinder access of hydrogen to the underlying metal.

This work attempts to unravel these two factors by growing oxide over-layers in the absence of adsorbed impurities (i.e. $O_2$ grown oxide), and exploring the influence of mean oxide thickness on hydriding induction times. Results indicate that the induction time is related to the oxygen consumption (during the oxidation phase) and increases with increase of oxygen consumption up to at least 25 μg $O_2$ $cm^{-2}$ (oxidation in pure oxygen at 80°C, 10 mbar; hydriding at 80°C, 100 mbar). Oxidation data from this work, shows an acceleration in the oxidation rate after a weight gain of 6 μg $O_2$ $cm^{-2}$ at this temperature; some have attributed this behaviour to cracking and / or spalling of the oxide which would result in a (possibly thinner) oxide barrier layer of constant thickness. However, the hydriding induction time, may continue to increase – albeit slowly - as the oxygen consumption exceeds this point.

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