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Hydration Structures and Water Chemistry at Zirconia-Water Interfaces BINYANG HOU, Sam Houston State University, CHANGYONG PARK, Carnegie Institution of Washington, SEUNGHYUN KIM, TAEHO KIM, JI HYUN KIM, Ulsan National Institute of Science and Technology, JONGJIN KIM, SEUNGBUM HONG, Argonne National Laboratory, CHI BUM BAHN, Pusan National University — Zirconia is an important material in numerous applications, such as gas sensors, solid oxide fuel cell electrolytes, and bio-medical materials. It also plays a key role on protecting zirconium alloys in highly corrosive environments found in pressurized water reactors. The degradation of the metal/oxide is primarily due to the interactions of surface oxide with water. Here we study the interactions of zirconia with water in terms of interfacial hydration structures at the 8 mol% yttria-stabilized zirconia (YSZ) surfaces using synchrotron-based X-ray reflectivity techniques. Interfacial hydration structures on three crystallographic orientations were determined with sub-angstrom resolution and compared with each other to identify common features and different surface chemistry effects on the interfacial processes. Meanwhile, zinc injection into the reactor coolant system has been known to be effective in both reducing radioactive wastes and stabilizing crud oxide layers of the metal alloys. We also studied the effect of zinc adsorption on the interfacial hydration structures of YSZs. Our X-ray reflectivity data reveal obvious hydration structure changes at (100) and (111) surfaces, but only minor changes at (110) surface. We further confirmed the detailed element specific adsorption profiles of Zn^{2+} ions near (110) and (111) surfaces with resonant anomalous X-ray reflectivity measurements.

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