PHASE STABILITIES OF Zr$_2$Fe and Zr$_3$Fe HYDRIDES*

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In processing of nuclear materials, getters play an important role in removal residual amounts of tritium from nitrogen gas streams. One of the most commonly used getters is the commercial ST198 (SAES) alloy. We have performed x-ray diffraction studies on Zr$_2$Fe, ZrFe$_2$ hydrides and the commercial alloy ST198. The major phase of this alloy is Zr$_2$Fe with some other minor phases. Buttons of alloy composition Zr$_2$Fe, and Zr$_3$Fe were prepared in our laboratories and thermodynamic and in-situ crystal studies were performed. Disproportionation was observed at elevated temperatures and was responsible for the reduced capacity for hydrogen and its isotopes. High temperature X-ray diffraction studies under N$_2$/H$_2$ environment showed that alloy did not react with nitrogen to form zirconium nitrides up to ~923K. The Zr$_2$Fe hydrides were stable up to 623K, but this temperature Zr$_3$Fe hydrides have been observed during hydriding of Zr$_2$Fe. Neutron scattering studies have also shown that Zr$_2$Fe begins to transform to Zr$_3$Fe by simple annealing; suggesting that phase stability of Zr$_3$Fe at around ambient temperatures. Results of neutron scattering, in-situ X-ray diffraction, isotherms of Zr$_3$Fe, and Zr$_2$Fe at different temperatures, and issues with the Zr-Fe phase diagram will be presented [1, 2].


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