

Determination of hydrogen concentration in Zircaloy cladding using hot vacuum extraction method with two-step heating

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The amount of hydrogen absorbed to the fuel cladding increases by extended burnup fuel. The absorbed hydrogen that exceed solid solubility limit precipitates as the hydride phase. The high concentration of hydride causes the fuel cladding embrittlement which might become the origination of fractures of the cladding. Therefore, it is important to measure the hydrogen content in the cladding to estimate the safety margin of the irradiated cladding. Hydrogen is absorbed not only in the cladding metal phase, but in the oxide layer. To evaluate the embrittlement of the cladding, it is necessary to measure the hydrogen content in the cladding metal phase and oxide layer separately. In the previous method of hot vacuum extraction, the hydrogen absorbed to the fuel cladding which strongly influences the cladding embrittlement was not able to be measured correctly because the amount of hydrogen released from melted cladding together with the oxide layer was measured. Therefore, the new device which can control the heat temperature was employed to measure the amount of hydrogen in the metal phase and the oxide layer separately by the two-step heating method. This paper shows the technical review of measuring method including the technique for the determination of extraction temperature.

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