Investigation of threshold stress level of radially reprecipitated hydrides: A phase-field approach

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Dry storage of the spent nuclear fuel (SNF) is an inevitable option in terms of ease and cost of SNF management. A Zr-based cladding has a strong tendency to absorb hydrogen and hydride precipitates as the cladding temperature during dry storage. The hydride in Zr-based cladding seriously degrade the mechanical integrity of the cladding, especially when it is radially oriented. The texture of the Zr-based cladding is originally controlled to induce circumferential hydride, however, it can be reprecipitated along radial direction under the applied stress with above threshold level. The phase-field method is a strong methodology to investigate morphological evolution of materials within the mesoscale. We applied KKS (Kim-Kim-Suzuki) multiphase field model with elasticity to evaluate threshold applied stress level to radially precipitate $\delta-$hydride on $\alpha-$Zr matrix affected by the temperature and dissolved hydrogen concentration. Our obtained threshold applied stress level can be a meaningful guide to find safe and economic environments of the dry stored SNF.