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# Comparison of simulated and observed cavitation-induced erosion damage in Spallation Neutron Source target vessels

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Cavitation-induced erosion patterns on the mercury-facing surfaces of Spallation Neutron Source (SNS) mercury target vessels were simulated using a newly developed parameter called the maximum bubble size. Explicit dynamic finite element simulations of the target vessels'structural response to beam pulses were performed. The cavitation bubble growth was calculated using a user defined subroutine based on the Rayleigh-Plesset equation with an initial bubble radius of 10 μm. The contour maps of the maximum bubble size value at the end of the simulation for each finite element on the mercury-facing surfaces were called the maximum bubble size maps. The predicated erosion patterns from the simulations were benchmarked with observations of erosion damage in the SNS target vessels during post-irradiation examination (PIE) and compared to calculations using a previous cavitation potential simulation technique called the saturation time. The gas injection technique has been deployed in the SNS target vessels to mitigate the cavitation-induce erosion damage and the maximum bubble size simulation was modified to account for the effect of gas injection. The patterns in the maximum bubble size maps for targets operated with and without gas injection agreed well with observations of erosion patterns on PIE samples from target vessels after service. The effect of gas injection rates on the damage potential simulation and an alternative parameter incorporating the bubble volume as a possible measure were also investigated.

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