A Model for Removal of Surface-bound Tritium Using Humid Air

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A model has been developed to describe the observed release rate of tritium from a research-scale laser inertial confinement fusion chamber during humid air purge cycles. The relative roles of successive rate limiting processes active during the purge cleaning process are assessed and incorporated into a system-level description that includes the coupled effects of convection, surface reaction, and sub-surface diffusion on tritium removal rate. The computational effort required for solution of the model equations is modest owing to the dominant roles of surface reaction and bulk diffusion, both of which may be adequately treated using low-dimension approximations. The resulting formalism is sufficiently general to be applied to a wide range of systems, materials, and process conditions involving water-gas interaction with tritium bearing surfaces.