Practical ablation models for IFE chamber design

Christophe S. Debonnel[1, 2] and Per F. Peterson[1]

[1]*University of California, Berkeley, CA, debonnel@nuc.berkeley.edu*
[2]*Lawrence Berkeley National Laboratory, Berkeley, CA*

Inertial Fusion Energy (IFE) targets will emit a considerable amount of energy in the form of x-rays. Those x-rays will deposit their energies in small layers of the target-facing material, vaporizing some of it. This is referred to as "ablation." In thick-liquid protected chambers, ablated mass and energy are essential in assessing the total impulse imparted to the liquid structures through the rocket-effect impulse, gas venting time, and pocket pressurization.

The Berkeley radiation hydrodynamics code "Visual Tsunami" [1] makes use of the open literature Lawrence Livermore EPDL---the Evaluated Photon Data Library [2]. Various ablation models are reviewed and implemented; also, differences are illustrated using a typical thick-liquid molten salt pocket. A new instantaneous model is proposed for ablation of high heat capacity molten salts. This new model justifies the traditional energy redistribution model, which assumes that all the x-ray energy deposited in the region between the cohesive and saturation depths is used to vaporize the molten salt. An extensive comparison of instantaneous ablation models to experimental results and other ablation codes is performed.

[1] C.S. Debonnel et al., "Visual Tsunami: A versatile, user-friendly radiation hydrodynamics design code," these proceedings
[2] D.E. Cullen et al., "The 1989 Livermore Evaluated Photon Library (EPDL)," UCRL-ID-103424, Lawrence Livermore National Laboratory.