



LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-TR-707452

Liquid Condensation and Solidification Behavior of Hydrogen Isotopes in Foams

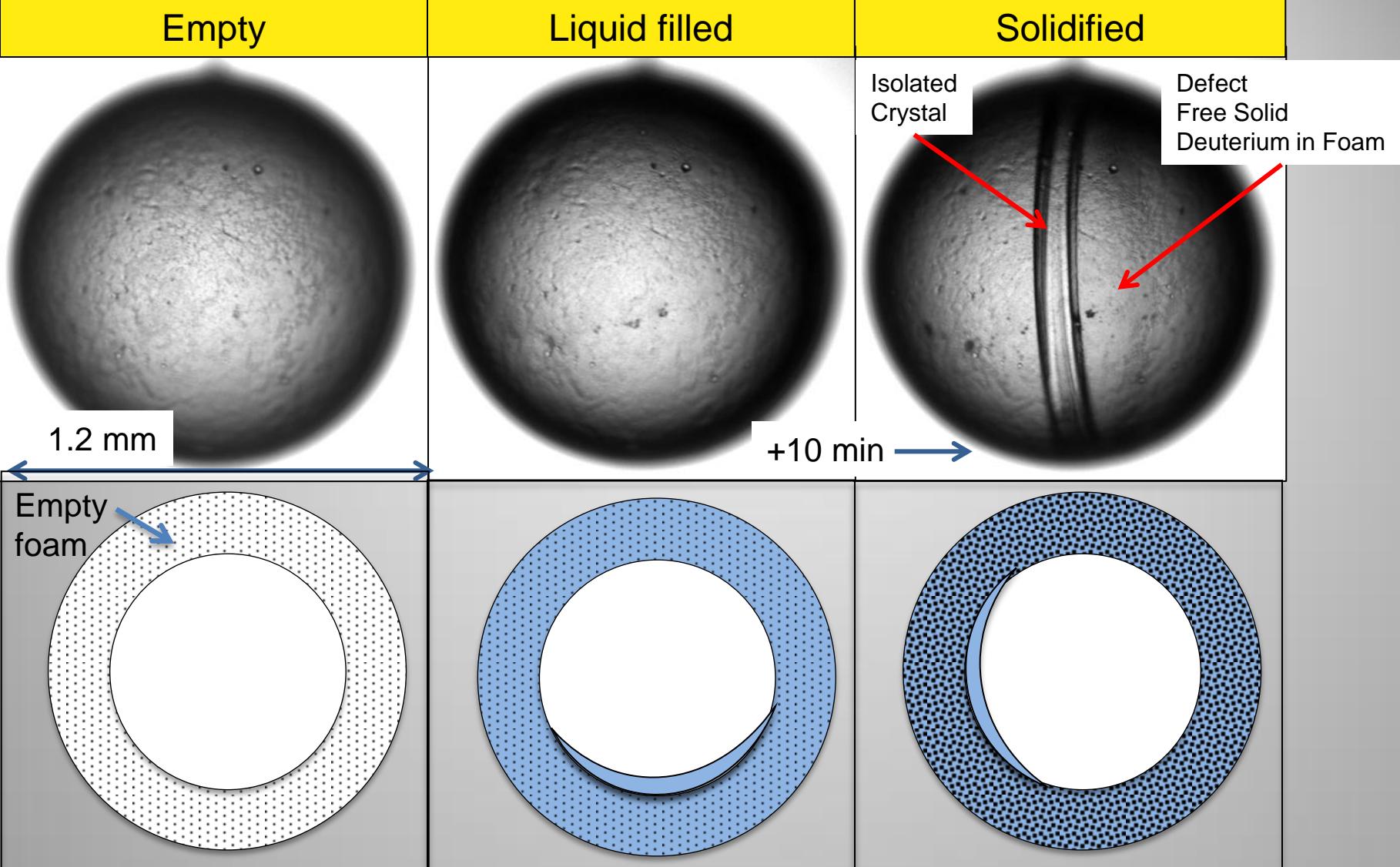
B. Kozioziemski

October 28, 2016

Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.



A foam shell, 1.2 mm outer diameter with a 35 μm thick foam layer is used to quickly form a solid deuterium layer for ICF. The top row shows the visible light microscope image and the bottom row shows a corresponding schematic representation. The left most image shows the empty foam shell, with the dark and light patches due to the foam imperfections. The middle image shows the foam shell with liquid deuterium filling the foam. In this case, the liquid level exceeds the foam level because the deuterium will shrink when it freezes. The right image is taken 10 minutes after the center image, after the temperature was reduced by 2 K to freeze the deuterium. This image shows that the majority of the solid deuterium has no observable defects, with the exception of the isolated crystal that formed on the foam surface. The next step is to get the correct level of liquid and cooling rate to prevent the extra crystal on the surface. In contrast, typical ICF DT fuel layers require \sim 13 hours to solidify in order to be defect free with a success rate of approximately 20%.