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IFE/P6-18: FIREX Foam Cryogenic Target Development: Attempt of Residual Voids Reduction with Solid Hydrogen Refractive Index Measurement

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To develop a Fast Ignition Realization EXperiment (FIREX) target, we have two strategies: a foam shell method and a cone guide heating technique for a Polystyrene (PS) shell. In this paper, the former method is focused. A target consists of a 500 micron foam shell with a ˜20 micron foam layer, a gold cone guide and a glass fill tube. A Resorcinol/Formalin (RF) material is utilized to create the foam shell. A foam layer is formed with aggregations of tiny cells. The porous foam material has the advantage to form a uniform liquid layer by capillarity. In the liquid-solid transition of fuel, however, their different densities would cause void spaces in each cell. Preventing the residual voids is one of important issues. The voids must come from random solidification. Continuous liquid fuel supply to a controlled solidification front would reduce the residual voids formation. We apply the effect of capillary attraction of the porous foam in a liquid state as the driving force of the continuous liquid fuel supply. Monotonic temperature gradient along a foam layer would realize the controlled solidification front. We demonstrate it in two steps. The first step is a basic study to lower the void fraction in formed solid hydrogen using a triangular prism shape foam plate. Eventually, the direction of a moving solidification front could be controlled by temperature gradient control along the plate. Based on hydrogen refractive index measurements, the residual void fraction was estimated less than ˜2%. (The void fraction of ˜11 % is calculated from the density gap.) Our proposed method was proved to be effective. Then the valid technique applies to FIREX foam shell target layering. For a real target, cone guide heating is useful to control the ideal temperature gradient in a foam shell. The controlled solidification front was successfully simulated using ANSYS code (ANSYS, inc). We are going to experimentally demonstrate FIREX foam shell target layering.

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