§3. Possibility of a RF Material as a Catalyst of Ortho-para Hydrogen Conversion

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The fuel layering for a Fast Ignition Realization EXperiment (FIREX) target has been studied under the collaboration between the Institute of Laser Engineering (ILE), Osaka University and the National Institute for Fusion Science (NIFS). A foam shell method is a candidate to realize a solid fuel layered target. A Resorcinol/Formalin (RF) shell has been developed in ILE, which is an aerogel material with a several 100 nm cell size instead of a foam material. Therefore experiments are conducted using the RF aerogel. Figure 1 shows a Scanning Electron Microscope (SEM) photograph of a RF aerogel layer.

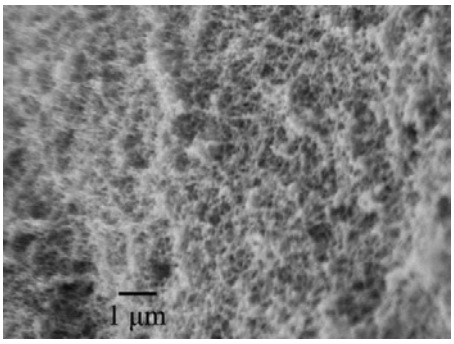

Fig. 1 SEM photograph of a RF layer.

For the demonstration of a voidless solid H_2 layer within a RF material, a prism shape RF was formed as shown in Fig. 2. Normal H_2 was liquefied and then solidified. To prevent the formation of residual void spaces, the temperature difference between the two copper blocks was controlled during the solidification process. To date, the reduced void fraction of ~2 % has been realized.

To avoid the effect of the ortho-para conversion for the estimation of the residual void fraction, the time dependence of the refractive index of solid H_2 was measured. Figure 3 shows the refractive index variation for ~ 1 day. The discontinuity at 240 min causes rearrangement of a mirror system. Except for the discontinuity, there is no variation of the refractive index. Without the existence of catalysts, several days are expected to reach a plateau of the para-H_2 state after normal H_2 was liquefied in the prism. It means the RF aerogel might be an effective catalyst of the ortho-para conversion because it has a similar chemical composition [1].

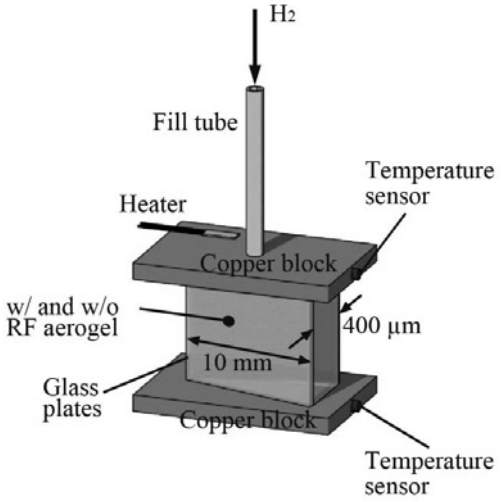

Fig. 2 Schematic of a RF prism.

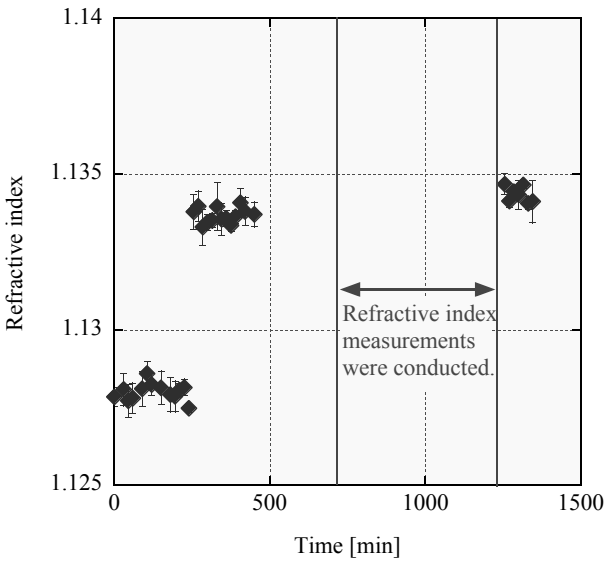

Fig. 3 Time variation of the refractive index of solid H_2 within the RF aerogel. The result at the wave length of 632.8 nm is represented.

1) C. A. Swenson, J. Chem. Phys. **18** (1950), 520.