Development of Sputtered Coated Glass Permeation Barrier

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We have developed a deuterium permeation barrier for CH shells with half lives of over 3 weeks by sputter coating ~ 1–2 m SiO2 layers. This provides a controllable uniform alternative permeation barrier to the traditionally used Polyvinylalcohol (PVA) which has the drawbacks of non-uniformity, shorter half lives (~ < 1 week) and the relatively large amount of time expended to produce a single shell.

We successfully optimized the sputter coating conditions to produce smooth uniform SiO2 coatings with enoughintegrity to allow routine handling as well as filling to the required pressures (20 atm). A key coating parameter was the mechanism used for to agitate the shells during coating. We found that agitation using gentle rolling produced coatings with half-lives of greater than 3 weeks, whereas a harsher bouncing agitation yielded half-lives of only a few days. Electron microscope and optical examination of these coatings revealed that the surface quality of the roll coated shell was much improved compared to bounced coated shells. The visible surface defects of the bounce coated shells possibly allowed a gross diffusion pathway in addition to standard bulk and grain boundary diffusion leading to the observed shorter half-lives

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