Effects of Ambient Gases On ICF Target Capsules

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Introduction

A schematic of the experimental apparatus is depicted above. Trans-2 butene and hydrogen provide the source for the CH polymer. This gas is injected into the resonator cavity where high electromagnetic field pulses thermally excite the gas atoms creating ionic discharges, i.e., plasma. The ions next combine and create a polymer, some of which is collected on the surface of the substrate. A quartz crystal monitor (QCM) serves as an accurate measuring device to determine the weight of polymer material collected on the substrate.

Experimental Approach

• Deposit plasma polymer on quartz crystal microbalance
• Allow material to remain in vacuum for preset time
• Vent system to dry nitrogen
• Begin dry air (controlled amount of oxygen)
• Begin humid air flow (capsules spend some lifetime in water for polishing)

Apparatus Photos

[Images of experimental setup and apparatus photos]

Nitrogen Absorption

[Graph showing nitrogen absorption over time]

Water Absorption

[Graph showing water absorption over time]

Oxygen Absorption

[Graph showing oxygen absorption over time]

Conclusion

We investigated the effects of gas exposures on plasma polymer material used for ICF fuel capsules. Nitrogen reversibly sorbs into plasma polymer. The amount is humidity dependent. Oxygen reacts irreversibly with the radicals. The rate depends on the oxygen concentration. Water reversibly sorbs into plasma polymer. The amount is humidity dependent. We hope to continue researching oxidation rate constants, gas degradation products, and mathematical modeling of plasma polymers.

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The plot above shows the growth of a plasma polymer, which is a temporary partial vacuum in the chamber during the first few microns of material, the polymer film continues to grow.