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# FLUIDIZED BED SHOWS PROMISE FOR IFE TARGET FABRICATION

General Atomics (GA), with our partner Los Alamos National Laboratory (LANL), is developing mass-production technologies for Inertial Fusion Energy (IFE) targets. This highlight describes recent results with fluidized bed technology for coating of very large batches of targets. This work is significant to the IFE program since high-rate, economical target fabrication is a "believability" issue with high visibility for IFE. Bringing industrial technologies to IFE target fabrication is needed to reduce the costs of fabrication. It is estimated that two 9-in. diameter fluidized bed coaters could supply about 500,000 shells per day (the quantity needed for a 1000 MWe power plant).

The objective of this work was to demonstrate the viability of a fluidized bed coating system to produce IFE target capsules. Regardless of the target type and driver, all proposed plant concepts have the common ground of a spherical shell containing the DT fuel. Any IFE target supply process must include fabrication of this spherical shell.

"Microencapsulation", with a triple orifice droplet generator can be used to mass-produce spherical shells. It is difficult to obtain thin and highly concentric walls with microencapsulation, especially at the larger shell diameters needed for IFE. However, microencapsulation can be used to provide mandrels made of poly(alpha-methyl styrene) (PAMS) with a highly spherical outer surface. A thin, highly uniform, polymer coating is then applied to the PAMS mandrel. The mandrel is removed by heating and diffusion of the PAMS components through the polymer wall, leaving a thin, concentric, spherical shell.

Currently, a "bounce pan" method is used to coat the PAMS mandrels to produce thin-walled capsules for the Inertial Confinement Fusion (ICF) program in small batches. While the bounce pan process produces excellent quality coatings, only a single layer of targets (~10–100) can be coated at once, rendering it unsuitable for the high production rate required for IFE (~500,000 per day). In contrast, fluidized bed processes are inherently suited for scale-up to large quantities, and are standard industrial practice. They also have been extensively studied and applied by GA to the production of gas-cooled reactor fuel particles.

A series of tests evaluating fluidized bed deposition of Glow Discharge Polymer (GDP) coating on mandrels was conducted. The fluidized bed is shown in Fig. 1. A view of the plasma is visible in Fig. 2. Figure 3 shows a GDP coating of approximately 3 microns thickness that was successfully deposited in the fluidized bed. These initial results are very encouraging for the applicability of this process to producing IFE target capsules. While proof-of-principle has been demonstrated, further work will be conducted to understand the parameters relating coating conditions to GDP layer properties and to optimize the coating. Abbas Nikroo of GA led the coating effort. From GA Bob Stemke, Erwin Castillo, Lloyd Brown, Gottfried Besenbruch, and Jennifer Van der Haeghen (a chemical engineering student from UC San Diego) contributed to these results.

Fig. 1. View of fluidized bed with ~500 2-mm diameter mandrels ready for coating (without plasma coil in place).

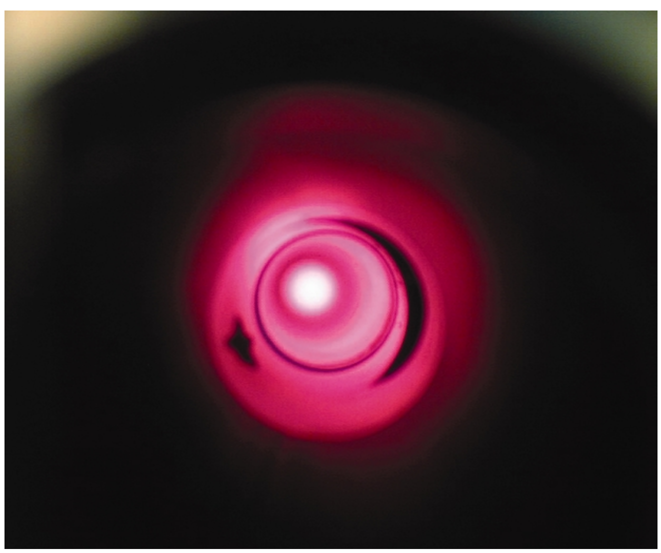

Fig. 2. Gas discharge plasma used to activate hydrocarbons for polymer coating.

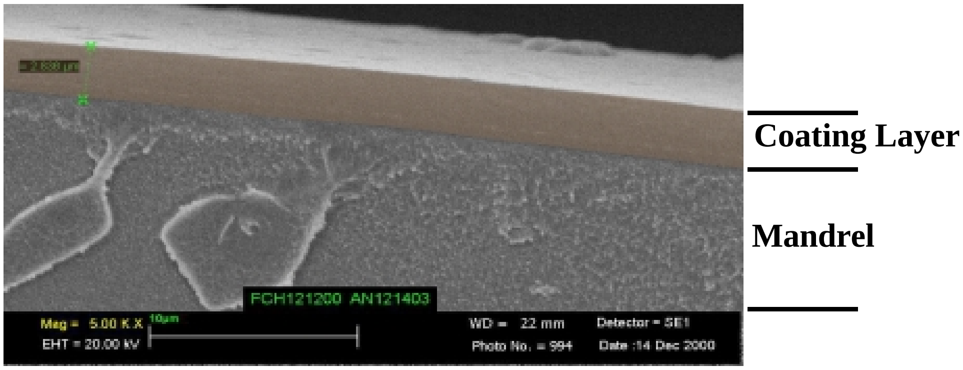


Fig. 3 Scanning electron microscope photo of ~3 micron thick GDP coating deposited on a PAMS mandrel in a fluidized bed.

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