Progress on the Los Alamos MARBLE Experiment, exploring prescribed mix and burn physics on the NIF

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This paper presents an update on the progress of the Los Alamos MARBLE experiments since the last IFSA conference [1]. MARBLE is an experimental implosion campaign using engineered foam with prescribed pore sizes to study the impact of mix on a burning plasma. By using this approach, we can prescribe the amount and morphology of the mix content. By morphology we mean the relative amount of atomically versus "chunk" mix. These experiments will provide detailed data that will be used to validate the LANL turbulence model and burn prescriptions [2-5]. We will present results from experiments on OMEGA both for implosion systems and for physics studies on shock propagation in engineered foams. We will also show results from early implosion experiments on the NIF.

In addition to providing an update on the experimental results, this paper will also present analysis and experimental results to address a few of the dominate identified difficulties with this experimental approach. In particular, we present results that demonstrate our ability to use foam in the implosion dynamics including understanding the equations of state, shock propagation and compression, of the foam targets. We will show results that demonstrate an excellent understanding of the impact of the carbon in the burning plasma and its impact on the reactivity for a fully mixed case of micro-pores. Finally, we will explore the relationship between the fluid mixing of the foam and the included gas and the plasma diffusion at the interfaces. These analysis will use both multi-physics codes such as RAGE [6] for the integrated knowledge of the conditions and high-fidelity codes for both direct numerical simulations of the fluid and kinetic and molecular dynamic simulations of the plasma interfaces.

We will end with a discussion of the directions we plan for MARBLE going forward as a platform that can address complex mix morphology in a burning plasma.

References

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