Designing low density foams by ALD templating

M.M. BIENER

Lawrence Livermore National Laboratory, Livermore, CA 94550, USA

Low density foams with precisely controlled architectures, compositions and densities have many promising applications in the fields of energy storage, catalysis, biomaterials, and high energy density physics. Here, atomic layer deposition offers a unique opportunity for rapid on-demand development of functional nanoporous bulk materials by applying the principle of templating to material systems for which robust synthesis strategies have already been developed. I will summarize recent progress made in synthesis and characterization of ALD-derived ultralow density target materials that are important for inertial confinement fusion (ICF) experiments. As porous substrates we use Polystyrene beads deposited by electrophoretic deposition, additively manufactured 3D micro lattices and nanoporous gold. Nanometer-thick metal oxide ALD coatings (ZnO, Ta_2O_5, Al_2O_3) provide the desired functionality and often dramatically improve the mechanical properties of the porous substrate. Even only nanometer thick coatings can be mechanically so robust that the substrate can be removed without collapse of the structure. The resulting materials can have air-like densities which, for example, enable the realization of brighter X-ray sources and promise to improve the performance of ICF targets.

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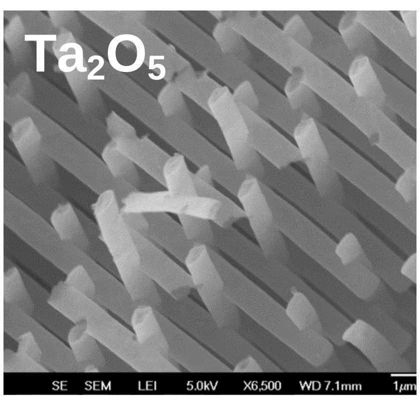

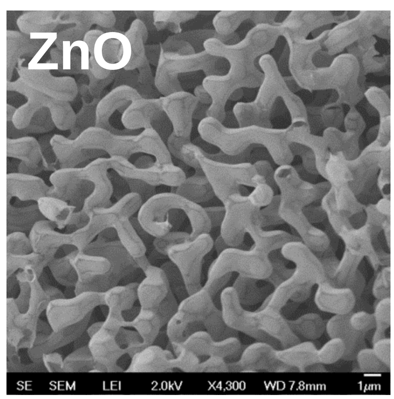

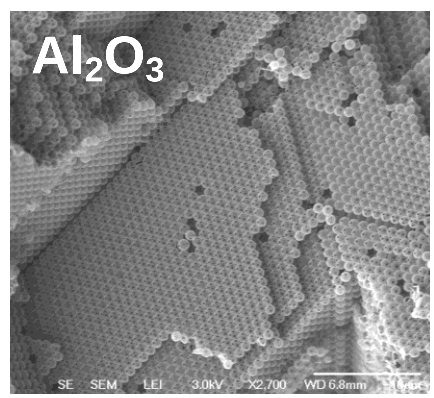

Presenter: Monika Biener, biener3@llnl.gov