

Rapid Materials Discovery and Functional Thin-Film Engineering with Direct Atomic Layer Processing (DALP®)

The development of functional thin-film materials often requires extensive experimental iteration to identify suitable compositions, thicknesses, material architectures, and processing conditions. Direct Atomic Layer Processing (DALP®) provides a localized and digitally controlled deposition approach that can accelerate this process by enabling multiple material variations to be produced on a single substrate.

This talk will introduce the principles of DALP® and its use for spatially controlled atomic layer deposition. Localized processing enables the fabrication of combinatorial material libraries, thickness and composition gradients, multilayer structures, and discrete test areas using a bottom-up approach, without requiring conventional full-wafer processing for each experiment. These capabilities support the systematic investigation of material properties and the efficient optimization of deposition parameters.

Examples will illustrate the application of DALP® to functional oxides, dielectric materials, and multilayer thin film systems. Particular attention will be given to the control of film thickness, composition, and spatial architecture. The talk will also discuss how localized deposition can shorten experimental cycles and support the rapid validation of candidate materials under device-relevant conditions.