Synthesis of Functional Materials by Atomic Layer Deposition

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Atomic layer deposition (ALD) is a thin film deposition technique that was developed in the 1970s to meet the needs for processing thin film electroluminescent displays (TFEL). Technically and chemically it is similar to chemical vapor deposition (CVD). However, in contrast to CVD, ALD incorporates as a specific feature the separation of the chemical reaction into two half-reactions. The exposure of the substrate to separate precursor vapors allows for chemical saturation of the substrate surface with a monolayer of the precursors and thus for a precise sub-Å growth control in a cycle by cycle manner. In addition, being a non-line-of-sight deposition technique, ALD allows for good coating conformality even with 3D nanostructured substrates or structures with a high aspect ratio together with a good capability for up-scaling.

This presentation will show a variety of approaches towards (multi)functional materials that were enabled by ALD. This process does not only allow deposition of compact thin films, but also area-selective and defect-sensitive deposition of clusters and nanoparticles, the bottom-up growth of porous thin films, and a top-down hybridization of inorganic and organic materials triggered by the diffusion of molecules. The resulting materials may serve as platform for the development of future advanced functional materials for use in energy storage, catalysis, plasmonics, and so on.