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Atomic Layer Deposition of Materials at the MIN Faculty: From History to Prospects

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Atomic layer deposition (ALD) relies on sequential self-limiting gas-solid surface reactions, facilitating conformal coatings with sub-nanometer precision on complex substrates while avoiding shadowing effects. ALD originated in the 1960s and 1970s; however, academic interest significantly rose approximately two decades ago with the commercial availability of the first ALD reactors for research and development in larger quantities. Shortly after the establishment of the MIN faculty in 2005, the initial ALD reactor was commissioned within the former Institute of Applied Physics in the Physics department. Since then, a dense network of collaborations has been established within physics and chemistry, as well as with external partners in the greater Hamburg area (TUHH, DESY, and Hereon).

ALD facilitates uniform and customized coatings across various dimensions, ranging from nanometer-sized pores to macroscopic superconducting radiofrequency cavities. The plethora of materials that can be deposited enables a wide variety of applications. We have utilized ALD to fabricate superconducting thin films, magnetic nanostructures, and customized semiconductors for detectors. Moreover, additional application areas in collaboration with internal and external partners have been addressed, including protective coatings for maintaining substrate biocompatibility and chemical stability, (electro-) photocatalytic applications, and photonic crystals.

This presentation will provide an overview of previous research on ALD in physics, but also chemistry, at the MIN faculty followed by a discussion of ongoing and future projects, including collaborations with IExp and DESY on the coating of SRF cavities, as well as with TUHH in the “BlueMat” Cluster of Excellence.

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