Deposition of ultrathin (nanoscale) layers by self-limiting atomic layer deposition

Short description: Self-limiting atomic layer deposition could be the next step in controlling the thickness in thin film deposition. Ultrathin (nanoscale) films are, for instance, required for the development of smaller, more efficient transistors.

Background: Nanoelectronics contain many different thin films. In the scaling of the electronics the films have become thinner and thinner. The deposition processes for these thin films have developed over the years from little control over thickness to a lot of control over thickness. The highest control we can have today is achieved by atomic layer deposition (ALD), which is based on surface-controlled reactions. In every cycle of an ALD process a defined thickness of the desired material is deposited.

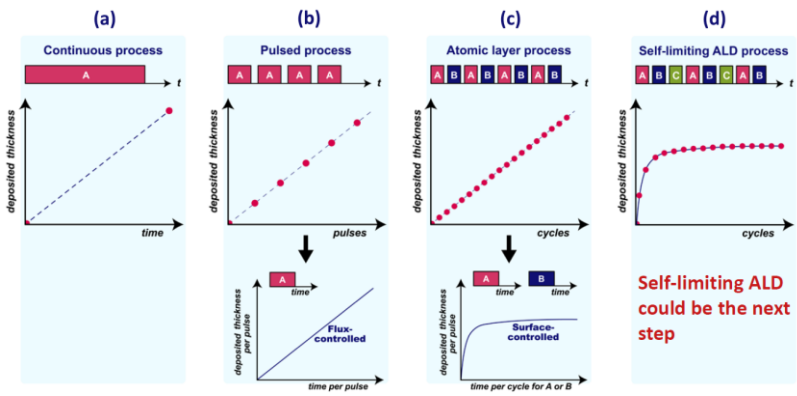

Figure 2. Development of more control in deposition thin film deposition processes, starting from continuous processes to pulsed processes, which are flux-controlled, to atomic layer processes, which are surface-controlled. The next step could be self-limiting ALD processes, which would be thickness limited.

The focus of this project is on exploring the possibility of terminating the ALD process when a certain thickness has been reached. The mechanisms and practical application of this termination have to be understood in order to design a model system.

Project: The goal of the project is to find out how we can achieve ultrathin film deposition. You will investigate with simulations what different options are to limit the ALD process and test the outcome in the lab. You will characterize the different surface reactions and will use them to limit the deposition.

Location and supervision: You will perform experiments in the labtuin which is located in Spectrum and you will perform simulations to predict and validate the experimental results. You will work in the nanoelectronics ALD subgroup, which is led by Adrie Mackus. Your daily supervisors will be Sanne Deijkers and Ilker Tezsevin.

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