Improving selectivity during area-selective deposition by ion sputtering

Short description: During area-selective deposition, the material only grows on a certain substrate material (growth-area) while growth is blocked on another substrate (non-growth area). So far, this can be achieved until 20-50 cycles of atomic layer deposition before material starts to grow on the non-growth area as well. Removing the deposited material on the non-growth area during deposition can help to push the boundaries of area-selective deposition.

Background: Area-selective deposition techniques are a promising processing techniques for future computer chips. By allowing growth only on a certain material and blocking it on another, perfectly aligned layers can be obtained. Also, because less lithography steps will be needed, the production is cheaper.

However, during area-selective processes some unwanted material (defects) will nucleate on the non-growth surface, indicated by the red line in figure 3. An etch step can be performed, for example using ions from an Ar-plasma, to remove the defects. This removal step might also remove some material from the growth-area (green line in figure 3) but ideally no material is etched here.

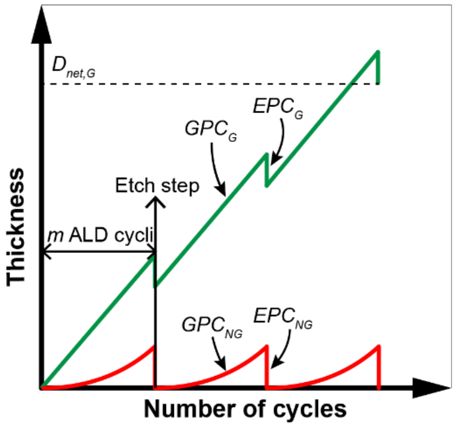

Figure 3. Thickness of the deposited layer over time during a supercycle area selective deposition and etch step. The red line shows the nucleation of unwanted defects on the non-growth area, which are completely removed during an etch step. The green line shows the deposition on the growth-area which is linear. After the etch step, some of this material might be removed as well.

Project: The goal of the project is to find whether ion sputtering (or another etch step) can remove defects while not etching the non-growth area substrate material nor the deposition on the growth-area. You will be choosing a set of materials to investigate and tune process parameters, like the bias power to control the ion energies. Deposition and etching is done in a commercial plasma ALD reactor. Sample characterization is done by XPS, in-situ SE and possible XRD. If all goes well, a graph like figure 3 can be made for the chosen set of materials.

Location and supervision: You will perform experiments in the cleanroom which is located in Spectrum. You will work in the nanoelectronics ALD subgroup, which is led by Adrie Mackus. Your daily supervisor will be Arthur de Jong.

If interested please contact:

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