Atomic Layer Deposition (ALD)

Instrument description

Atomic Layer Deposition is a deposition technique for very thin layers with the thickness control down to a single atomic layer. It belongs to the CVD techniques family. The thickness precision is achieved by pulsed deposition, where first a metal-containing precursor is introduced into the chamber and after a short time (allowing for a monolayer adsorption) the chamber is pumped down. Following step is an exposure to the oxidizing precursor (for oxides) or nitrogen containing precursor (for nitrides). Thus, a monolayer of target material is grown. The metal-containing precursors are usually organometallic ones, for oxidation a water or oxygen plasma can be used, nitridation is done using water or nitrogen plasma. To achieve the deposition in the ALD mode, sample is heated up to a certain temperature, for most processes being in the range 150 °C - 300 °C.

Instrument: Ultratech-Cambridge Nanotech Fiji 200

ALD system for up to 8" samples, equipped with plasma generator.
Standard materials: Al_2O_3, AlN, HfO_2, HfN, TiO_2, TiN, SiO_2, SiN, other materials on request.

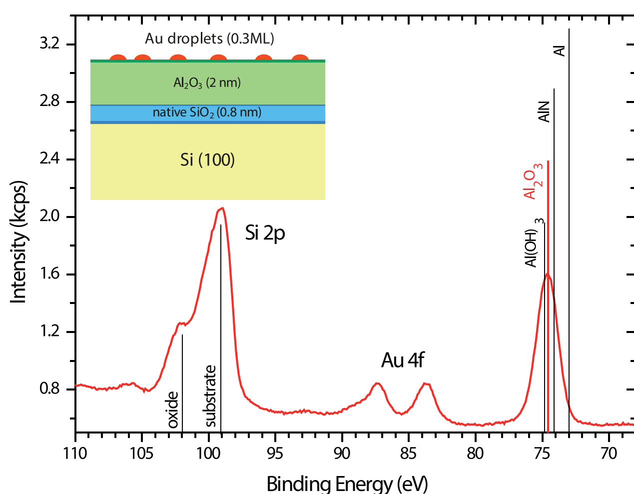
Features:

- thermal deposition within range RT-500 °C
- 4 precursor lines, with possible upgrade to 6
- plasma-enhanced deposition (3 plasma gas lines)
- expo mode for homogeneous deposition on high-aspect-ratio nanostructures
- controlling software allows preparation/ /modification/storage of individual recipes
- fully automatic programmable operation

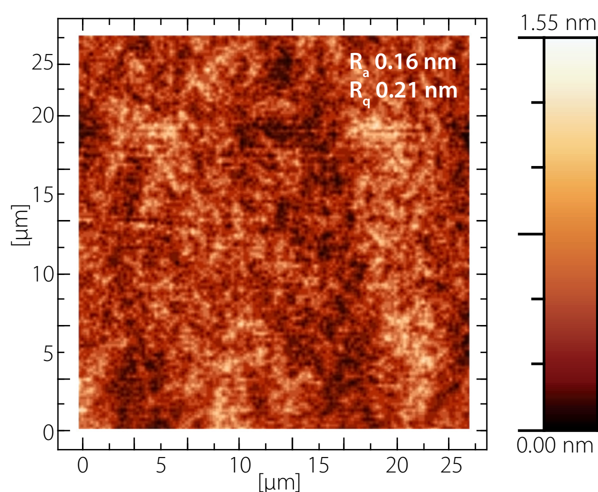
Application

Al_2O_3 diffusion barrier deposition

XPS analysis



AFM analysis



Technical specification

General info:
Up to 8 inch sample size
Deposition uniformity 1.5 % (1σ) for Al_2O_3

Delivery/Carrier system:
- solid, liquid and gas precursors heated up to 200 °C
- ALD Booster™ for low pressure precursors
- 3 x mass flow controlled plasma lines, 200 sccm

4 precursors lines

plasma chamber/generator

reactor chamber
with sample plate heated up to 500 °C

precursor trap

purge/plasma gas lines

control computer

electronics

stop valve

dry pumping system

Deposition modes:
- high speed
- high aspect ratio
- plasma assisted

Operational modes:
- Continuous™ mode
- Exposure™ mode
- Plasma™ mode

sample process:
Al_2O_3 from water and TMA

aluminium
carbon
hydrogen
oxygen

initial surface
ALD CYCLES
precursor flows in
precursor adsorption and desorption of reaction products
chamber purge
second precursor flows in
reaction with the adsorbed layer and desorption of reaction products
chamber purge
ALD CYCLES
thin layer after deposition

Contact

Core Facility: Nanofabrication and Nanocharacterization

Section: Etching & Deposition

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