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Pulsed Laser Deposition : gaining atomic control

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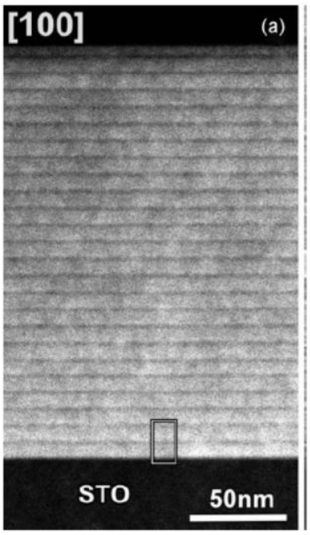
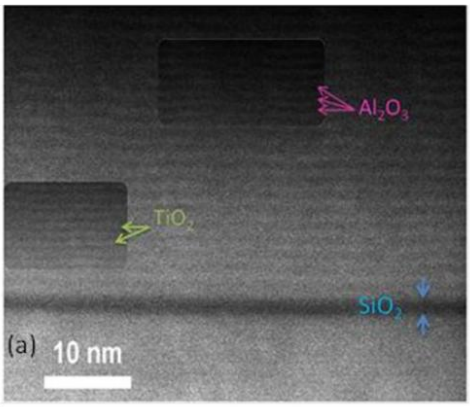
Pulsed Laser Deposition (PLD) is renowned technique for the deposition of high-quality thin films, especially for binary or complex oxides. The pulsed character of the source, i.e. the plume created by the laser pulse, allows to control finely the deposited film volume, down to the amount of matter deposited by each single pulse. For relatively slow deposition rates, this amount may be just a fraction of a full atomic layer, so thickness control in the atomic range can be gained rather easily using PLD. However, the calibration process of the growth rate and the after-growth control of the actually deposited amount of material may become rather challenging.

I will show some examples of the PLD growth of thin films, where such an atomic control is asked for: superlattices, reaching the limit of one unit cell for at least one of the two materials, amorphous laminates with sub-nanometric individual layer thicknesses going down to single atomic layers, and solid solutions deposited from two targets, where thicknesses below a single unit cell are necessary. I will also include a description the necessary experimental procedures to control and characterize the obtained structures, with a special focus on the reproducibility and the limits of this atomic control. And for sure, some interesting applications of such materials!



$LaVO_3$ (18 u.c.)/$SrVO_3$ (3 u.c.)

P. Boullay et al, PRB **83**, 125403 (2011)



Al_2O_3 (0.5 nm)/TiO_2 (0.5 nm)

M. Ben Elbahri et al,
J. Phys. D: Appl. Phys. **51**, 065101 (2018)