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PULSED-LASER GROWTH OF COMPLEX OXIDES: ROLE OF TINY CATION NONSTOICHIOMETRY

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The rise of semiconductor-based electronics has gone hand in hand with the technological advancements allowing to reproducibly prepare materials with exceptionally small concentration of defects. A similar control of defects and composition is the key to making all-oxide electronics a reality, allowing to fully exploit the multitude of functionalities of these materials. While pulsed laser deposition (PLD) can in principle produce these high-quality films, growth experiments often result in rough surfaces and nonstoichiometric compositions.

To understand the cause, we follow the growth of $SrTiO_3$(110) and $La_{0.8}Sr_{0.2}MnO_3$(110) at an atomic level from the early stages as a function of the growth conditions, using atomically resolved STM. We observe that small non-stoichiometries introduced during growth accumulate at the surface, and result in an evolution of the surface structures along a phase diagram. This can produce dramatic effects on the morphology of the films [1] and can cause the precipitation of secondary phases. On the bright side, I will also show how one can take advantage of the accumulation of cation nonstoichiometries at the surface: Quantitatively measuring the evolution of the surface structure with STM can be used as an extremely sensitive tool to push the detection limit down by at least one order of magnitude [2].

[1] Phys. Rev. Research **1**, 033059 (2019)

[2] Phys. Rev. Mater. **3**, 043802 (2019)

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