

"From oxide thin films to freestanding membranes: opportunities of chemical deposition methods"

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Oxides provide unique physical and chemical properties inspiring rapid materials chemistry innovations, which enable precise design and nanoengineering of compositions for myriad device implementations. Chemical deposition methods attract interest as versatile approaches to develop complex oxide thin films, nanostructures, and freestanding membranes by properly selecting compatible chemical precursors and designing an accurate, cost-effective thermal treatment. This talk outlines the distinctive characteristics of solution processing (CSD) and atomic layer processing (ALP) followed by a concise review of our group's successful oxide depositions. The main focus will be on the study of freestanding complex oxide membranes prepared by the water-soluble sacrificial approach, which empowers a real opportunity to apply single-crystal complex oxides in practical electronic and energy devices. I will detail the influence of sacrificial layer stoichiometry and crystallinity on the quality of the oxide membranes, followed by the possibility of inducing controlled topographic membrane corrugations to locally modulate their properties by strain. These advances pave ways for next-generation mechanically reconfigurable multifunctional electronic devices.

Related publications

- M.Coll, J. Fontcuberta et al. (2019) 482, 1-93, Applied Surface Science, Towards oxide electronics: a Roadmap
- P. Salles, MColl et al. Adv. Mater. Interfaces, (2021), 8 , 2001643 Facile chemical route to prepare water soluble epitaxial $\text{Sr}_3\text{Al}_2\text{O}_6$ sacrificial layers for freestanding oxides
- P. Salles, MColl et al. ACS Applied Materials & Interfaces (2022) 14, 10, 12845–12854; Bendable polycrystalline and magnetic CoFe_2O_4 membranes by chemical methods
- P. Salles, MColl et al. Adv. Funct. Mater., (2023), 2304059; On the role of the $\text{Sr}_3\text{xCa}_x\text{Al}_2\text{O}_6$ sacrificial layer composition in epitaxial LSMO membranes
- P. Salles, MColl et al. Chem Commun (2023), 59, 13820-13830 Chemical synthesis of complex oxide thin films and freestanding membranes
- P. Salles, MColl et al. ACS applied materials & interfaces (2024) 16 (28), 36796-36803 Unfolding the challenges to prepare single crystalline complex oxide membranes by solution processing