ULTRATHIN METAL OXIDE and NITRIDE FILMS:

BRINGING THE WELL-KNOWN COMPOUNDS

TO A UNIT-CELL THICKNESS

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Bringing the well-known bulk materials to a unit-cell thickness may significantly influence their structure and physicochemical properties. As an example, ultrathin (< 1 nm-thick) films of metal/non-metal compounds, such as metal oxides, nitrides or sulfides epitaxially grown on single-crystal supports, are characterized by unique electronic, catalytic and magnetic properties not observed for their bulk counterparts. Such films also exhibit superior structural flexibility, undergoing phase transitions upon exposure to external factors (such as traces of reactive gases or high temperatures) [1,2]. All this makes them promising candidates for applications in various technological fields, including nanoelectronics, spintronics and heterogeneous catalysis. The lecture will focus on the growth, structure and properties of ultrathin metal oxide and nitride films, with iron oxides and nitrides as exemplary cases. The scanning tunneling microscopy (STM), low energy electron diffraction (LEED), X-ray photoelectron spectroscopy (XPS), low energy electron microscopy (LEEM) and density functional theory (DFT) results – obtained by our group and external collaborators – provide universal guidelines for designing ultrathin film metal oxide and nitride systems with a desired structure and properties.

[1] Y. Wang, G. Carraro, H. Dawczak-Dębicki, K. Synoradzki, L. Savio, M. Lewandowski, Applied Surface Science 528 (2020) 146032.

[2] N. Michalak, T. Ossowski, Z. Miłosz, M. J. Prieto, Y. Wang, M. Werwiński, V. Babacic, F. Genuzio, L. Vattuone, A. Kiejna, Th. Schmidt, M. Lewandowski, Advanced Materials Interfaces (2022), DOI: 10.1002/admi.202200222.

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