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PhD thesis proposal 2020 (3 years – Oct. 2020)

Oxides perovskite growth by PLD on polycrystalline substrates and their properties characterized by scanning probe microscopy under ultrahigh vacuum and variable temperature

Keywords : Laser ablation, Oxydes thin films, Scanning probe microscopy, Ultra High Vaccum, Cryogenics

Requested skills : The candidate must have a solid background in materials science (chemistry and/or physics). A good knowledge of the physics of condensed matter (electronic properties and / or magnetism) and / or of the synthesis and characterization of crystallized complex oxides is highly desirable.

The aim of the PhD project is the growth by Pulsed Laser Deposition and study functional oxides on polycristalline substrates by scanning probe microscopy. Complex oxides materials offer properties such as superconductivity, ferromagnetism, ferroelectricity, multiferroism, *etc.*, which are not present in semiconductors and are thus very promising for the development of a new generation of materials in microelectronics, Oxide-based electronics: "oxytronics". Howerver, these materials are usely deposited on monocrystalline substrates, which offer a limited choice of materials and crystallographic orientations.

In our laboratory, we used a new approach: Growth on Combinatorial Substrate Epitaxy (CSE). Those polycrystalline substrates have domain sizes of a few micrometers and each grain exhibit a specific crystallographic orientation. So, each grain can be viewed as a single crystalline substrate. Thus, thousands of differently oriented substrates are avalaible for one deposition. Consequently, for each material, we can study and isolate the best orientation- property relationship. This is particularly important in order to exploit the functional properties of complex oxides, whose anisotropies (magnetism, ferroelectricity, etc.) are typically related to their crystalline orientation.

The films will be characterized by scanning probe microscopy under ultrahigh vaccum and variable temperature, which allows us to map physical properties of thin films from nanometer to micrometer scales. Different modes will be used such as Kelvin microscopy (KPM), magnetic Force Microscopy (MFM), Piezo Force Microscopy (PFM)…

Therefore, the doctoral student will be trained to pulsed laser ablation, crystallographic characterization as well as near-field microscopy at variable temperature (cryogenics) under ultra high vacuum. This multidisciplinary training should ultimately facilitate the entry of the doctoral student into the world of research.

Application:
Please send your application documents including a detailed CV and a motivation letter dedicated to the proposed position before May 27, 2020. You may add additional documents such as the marks and ranks you obtained during your master degree or engineering school, or references letters.

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