Proposal for a fully funded PhD position (2025-2028)

in the frame of the ANR project ULTRAZO

Dynamics of laser induced modifications in doped zinc oxide using pump probe experiments

Context

Transparent conductive oxides (TCOs) are optically transparent thin films of metal oxides used as functional thin films in many applications such as photovoltaics, OLEDs, touch screens, insulating and smart glazing and are crucial for energy transition. High conductivity TCO films require an energetically costly baking step of the film/substrate system, which makes it difficult to decorrelate crystallization, diffusion, activation and defect formation processes that have different activation times and energies. The very large surfaces necessary to cover all these needs together with environmental concerns demand high yield fabrication processes with abundant non-toxic materials and with the lowest possible energy and raw material consumption.

Topics

This PhD is part of the ANR ULTRAZO project, whose goal is to intimately understand and master the local laser modification dynamics at different time scales in out-of-equilibrium inorganic metal oxides. The idea is to deliver precise amounts of energy with precise spatial and temporal widths to control the transformations and strongly reduce undesired processes.

Thesis objectives:

- Implementing pump-probe characterization techniques in regimes of reversible or non-reversible modifications of the AZO thin films.
- Characterizing the evolution of the excess carrier density and the recombination time in the different samples and contributing to the optimization of the AZO film properties.
- Characterize the permanent modifications induced by ultrafast lasers.

The student will interact with a second student (to be hired) studying permanent modifications induced by lasers in sputtered AZO films, but also with a postdoc (to be hired) carrying out atomistic simulations.

Partners

This thesis will take place between two main laboratories. “Laboratoire Hubert Curien” in Saint-Etienne and “Surface du verre et interfaces”, a joint unit between Saint-Gobain and the CNRS within the Saint-Gobain Research center in Aubervilliers.

Student profile

Master 2 in research or engineering school with specialization in physics, optics or materials science. Knowledge of solid-state physics, laser matter interaction and/or non-linear optics would be an asset. The candidate should demonstrate a strong aptitude and enthusiasm for conducting experimental research, particularly in the use and development of ultrafast laser instrumentation, spectroscopy and data analysis.

Starting date

The PhD work can start between January and October 2025 depending on the graduation date of the applicant. M2 students willing to apply for October 2025 are strongly encouraged to apply for carrying out their Master thesis in our groups.

Contacts

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