Optics of liquid crystals and plasmonic oxides for intelligent glass

Location: Centre de Recherche Paul Pascal, Université de Bordeaux
Partners : Saint-Gobain Recherche and Laboratoire de Physique de la Matière Condensée, Polytechnique

Figure 1: (a) Polarizing optical micrograph of toric focal conic domains in liquid crystal films. (b) Image of an insulating window. (c) Image of controllable scattering in a window for privacy applications.

Open PhD position

A major part of the innovation efforts of the glazing industry focuses on giving to native glass new functionalities such as hydrophobicity, self-cleaning, anti-reflection, solar control, privacy, scattering, thermochromic, and electrochromic properties.

Within this industrial context, a situation that has yet to be explored concerns the optical properties of plasmonic oxide nanoparticles, deposited on the surface or embedded in glass. Such systems are good candidates for solar control, scattering, privacy, voltage-induced color modulation, and thermochromic properties. Since liquid crystals can be deposited on glass surfaces on square meter surfaces, active composite glass could be fabricated at industrial scales.

To reach the set of functionalities mentioned above, the research hypothesis relies on the promising, as yet unexplored synergetic combination of the intrinsic individual properties of both major components of the composite films: on the one hand, the latest anisotropic plasmonic oxide nanoparticles, which are able to absorb and scatter electromagnetic radiations within both the whole visible and entire infra-red wavelength ranges; on the other hand, liquid crystals, which can orient and organize anisotropic colloids, respond to electric fields, be sensitive to temperature, and strongly scatter light on their own.

The PhD work will consist in understanding the scattering mechanisms involved in liquid crystals with and without plasmonic oxides both experimentally and theoretically. This will enable the design of promising routes in the fabrication of intelligent glass systems that control scattering and transmission of light through glass over various wavelength bands.

Candidate

Candidates should hold an MSc or Engineering in Physics or equivalent. Ideally, the candidate should have some experience in computational and experimental optics and modelling. We seek candidates with excellent oral and written skills in English who are able to work collaboratively in a research team (ANR funding available).
Software available: COMSOL Multisphysics, T-Matrix code, Mie scattering codes
Interested Applicants should send their CV and letter to alexandre.baron@u-bordeaux.fr