

Thesis subject: Optical coatings

Name of the laboratory: Institut Fresnel

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Subject's title: Multilayer structures with striking visual effects for art and security applications

Optical coatings provide an efficient method for the production of colored surfaces. Wide range of colors with various parameters (contrast, hue, brightness...) can be achieved by combining metallic and dielectric layers. These structured can then find a wide range of application including architecture or automotive (colored glasses), safety elements (banknotes) or art.

Over the past few years, we have developed accurate and predictable methods for the production of colorimetric structures with performances that go beyond what can be achieved with pigments available in nature [1]. We have also demonstrated that these colors can be modified thanks to the use of phase change materials [2].

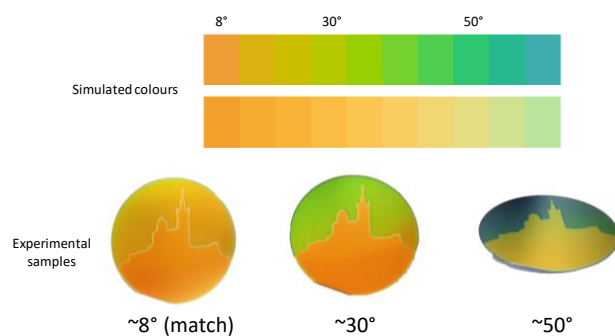


Figure 1. Example of simulated and experimental angular colorshift of metameric pairs

Within this thesis, we propose to continue these activities, concentrating the research on the following activities:

1. Develop metrology for accurate characterization of colorimetric coordinates of multilayer structures.
2. Develop multilayer structures with various colors controlling hue, chroma and luminance.
3. Theoretically and experimentally study the effect of substrate and light properties on the visual aspect of multilayer colorimetric structures.
4. Develop new multilayer structures with color switching effects.

The candidate will work within the thin film research team of Institut Fresnel, both on numerical simulations and experimental demonstrations that will be carried out in cleanrooms. The candidate must have a Master in Science with good knowledge in optics, programming and if possible in optical thin films.

Bibliography:

[1] R. Shurvinton, F. Lemarchand, A. Moreau, and J. Lumeau, "High-Chroma Color Coatings Based on Ag/SiO₂/Ti/SiO₂ Structures", *Adv. Photonics Res.* 2200102 (2022).

[2] R. Shurvinton, A. Karimbana-Kandi, P. Dominic, F. Lemarchand, A. Moreau, and J. Lumeau, "High-Chroma, High-Contrast Tunable Color Coatings Using Sb₂S₃ in a Metal-Dielectric Stack", *Adv. Photonics Res.* 2022, 3, 2200102 (2025).