Master internship

Internship/job title	**Synthesis of colored glasses by an innovative sol-gel/laser coupled approach**
Location :	Laboratoire PMC – Ecole Polytechnique – Route de Saclay – 91128 Palaiseau
Contact :	Simon Delacroix
email/ telephone	simon.delacroix@polytechnique.edu - 33 (0)1 69 33 46 96 thierry.gacoin@polytechnique.edu elise.medina@saint-gobain.com
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The synthesis of transparent thin films of various colors with good mechanical properties and capable to resist to high temperature treatments is still a synthetic challenge. The use of inorganic nanoparticles as pigments is of a major interest due to their thermal stability but some issues has to be address. In addition to security problems during the manipulations of nanopowders, the control of the nanoparticles size during the colloidal synthesis and the dispersion of particles inside a glass matrix are not easy to overcome. To face these limitations, we propose an original pathway of *in situ* nucleation of nanoparticles inside a glass matrix thanks to a laser treatment. The laser annealing has indeed many advantages such as a local heating with fast temperature ramps allowing the reduction of the nanoparticles growth ensuring a homogeneous coloration.

In this project, a synthetic pathway based only on liquid soluble precursors of glass and inorganic pigments will be used. First, a reactive thin film will be prepared on a substrate thanks to the formulation of a sol avoiding the precipitation of metallic silicates. This sol-gel film will then be annealed to form a glass matrix and a laser treatment will insure the nucleation and/or the crystallization of the colored nanoparticles. The influence of the different parameters (composition, temperature…) will be studied. Several pigments are targeted such as plasmonic particles, mixted valence compounds or classical pigments. The different materials will be characterized thanks to various analytical methods (XRD, SEM, EDX, UV-Vis, Raman…).

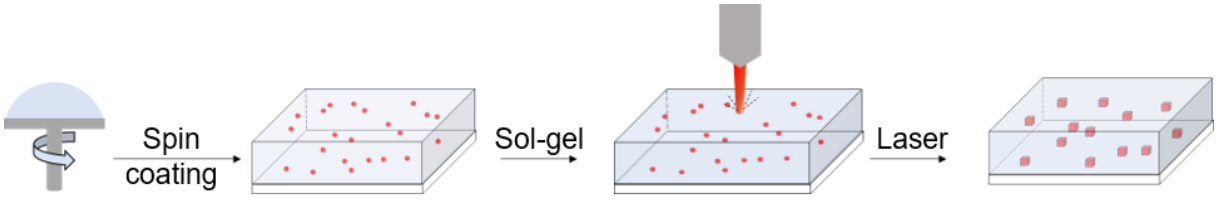

Figure 1. Synthetic pathway of a colored glass: deposit of precursors by spin-coating followed by an annealing to obtain a gel. A laser treatment induced the crystallization of colored nanoparticles inside the glass matrix.

This internship will be located in Ecole Polytechnique but will be funded Saint-Gobain. The candidate (3rd year engineering student or 1st or 2nd year of a master's degree in materials or inorganic chemistry) will benefit from strong interactions with Saint-Gobain research center and will have to communicate (written and oral) the internship results in English. A taste for experimental work and great autonomy is required for this internship.