POST-DOC OFFER (2 years)

Texture and resistivity of model silver-based low-emissive coatings: the input of ion beam assisted sputtering deposition

Context and mission

Energy saving is a key in the energy transition. In this context, the glass manufacturer Saint-Gobain develops since many years low-emissive or anti-solar glazings for housing. If convection and conduction are handled by the double-glazing structure, the radiative thermal transfer is limited by complex stacks of metallic and dielectric layers deposited at the glass surface by magnetron sputtering under vacuum. The active layer in the infra-red reflection is a polycrystalline silver film which thickness of the order of ten of nanometres insures transparency in the visible range. The insulating performances are intimately linked to the electrical resistivity of the metallic film, which in turn is governed by its microstructure, that is to say the density and the nature of the grain boundaries and the quality of interfaces. Thus, the industrial challenge is to obtain a silver film with the lowest resistivity and the best crystallisation starting from an amorphous glass substrate. To do so, the metal is encapsulated in between ZnO layer, which columnar growth along the c-axis of the wurtzite structure, favours a (111) silver out-of-plane texture through a good epitaxial match. However, so far, the gains in resistivity via the deposition parameters or the nature of the layer have been only incremental. Yet, recent experiments with single crystal substrates have demonstrated the paramount role played by the in-plane texture *i.e.* the relative orientations of the grains in the electrical transport.

In this industrial context, the idea is to explore the potentialities of an innovative technique, namely the Ion Beam Assisted Sputtering (IBAS). On the silver seed layer, the ion bombardment favours the orientation of some crystallites compared to the beam direction, and hence the in-plane texture of the metallic film. The applicant will have to develop a full comparison with reference coatings and single crystal substrates through x-ray diffraction measurements and resistivity characterisations at low temperatures.

Activities

- Growth of model stacks with and without ion beam; exploration of the relevant IBAS depositions parameters to texture the seed layer;

- Structural characterisations by X-ray diffraction (out-of-plan; grazing ; reflectivity) of stacks;
- Low-temperature resistivity measurements and their modelling.

Competences

- PhD in physics or chemistry of materials;
- Knowledges of physical vapor deposition techniques under vacuum such as magnetron sputtering
- Knowledges of characterization techniques, such as X-ray diffraction and/or transport measurements

Institutions and contract

The contract (2 years; 2744 à 3897 € gross salary per month depending on experience) is funded within Plan France Relance on a collaborative research project with a company that has to be validated by DRARI. The post-doctorant fellow will work on the sites of the two structures:

- Institut of NanoSciences of Paris, CNRS/Sorbonne Université, Equipe "Oxides in Low Dimensions" (https://w3.insp.upmc.fr/)
- Saint-Gobain Research, Aubervilliers (https://www.sgr-paris.saint-gobain.com/)

Contacts

1- R.Lazzari, Institut des NanoSciences de Paris (INSP), Email : remi.lazzari@insp.jussieu.fr
2- Denis Guimard (SGR), E-mail : denis.guimard@saint-gobain.com
3- Hervé Montigaud (SGR), E-mail : herve.montigaud@saint-gobain.com