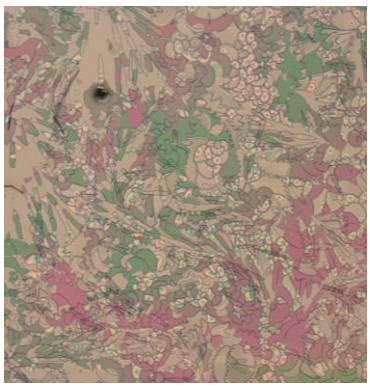
Relationship between microstructure and mechanical properties of silica sol-gel

CONTEXT


Sol-gel layer cracked on silicon at 600°C

Many functions are provided to Saint-Gobain glazing by depositing coatings to provide thermal insulation function for buildings or transport field and to provide new optical or surface properties like hydrophobicity/hydrophilicity, improving scratch resistance or aesthetic functions. As many glass products undergo thermal toughening, giving the glass better mechanical resistance. In that case, the development of functional coatings resistant to high temperatures (> 600°C) is a major challenge. To address this issue, sol-gel coatings are particularly interesting candidates. Indeed, the inorganic nature of the precursors used gives them good temperature resistance and allows good covalent adhesion to the glass substrate.
One of the limitations of these materials is however linked to the high stresses that appear during the condensation of the network and the evaporation of the solvents generating cracks in the layers. The relationship between the thickness of the coatings, their composition and this phenomenon of cracking is well known from the literature and some protocols to measure the stresses in the layers have already been developed. However, several phenomena occur when the glass is heated above its Tg such as the diffusion of sodium towards the layer, which may modify the layer's behavior in temperature.

GOAL OF INTERNSHIP

An initial study was conducted on a reference silica sol-gel formulation, which revealed a linked evolution between microstructure and stresses. The internship aims to repeat this study on a hybrid silica sol-gel formulation containing an organic component. The goal is to identify whether the organic component allows subtle change in the microstructure and associated stresses during temperature rise.

To this end, the student will be trained in sol-gel synthesis and deposition, Raman spectroscopy to study the layer structure, which he/she will link to stress and mechanical measurements using nanoindentation.

PROFILE

Engineering school student or Master 2 with knowledge in materials chemistry and/or mechanics with a taste for experimental and teamwork, rigor and a great deal of autonomy. Written and oral comprehension in English and French is required. The internship will consist of chemical synthesis and mechanical tests, so the candidate must have an interest in both chemistry and materials mechanics.

DURATION

6 months

LOCATION

Saint-Gobain recherche Paris

41 quai Lucien Lefranc,
Aubervilliers

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