Chemistry Department

GLASS COLOURATION – METAL

REQUIMTE/ Photochemistry and Supramolecular Chemistry Group
VICARTE

Márcia Ventura

2001: Graduation in Chemical Engineering - Applied Chemistry, IST, Portugal.

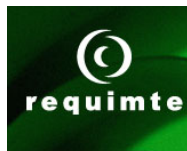2008: PhD in Chemical Engineering, ITN-IST, Portugal.

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Objectives

Glass colouration based on the layer-by-layer (LbL) method having in mind its application in glass art pieces.

Polyelectrolyte multilayers (PEMs) films produced through the LbL method are used for the in situ synthesis of Au and Ag metal nanoparticles on float glass surface in order to colour it. The influence of variables on the colouration of the glass, such the number of layers used to form the PEMs, the time duration of thermal treatment, and the presence or absence of Sn in the glass surface is determined.

Methodology

The LbL method is based on the sequential deposition of oppositely charged species, the polyelectrolytes, onto a substrate. The nanoparticles are synthesized in situ using the functional groups of the polyelectrolytes as binding centres for the metals precursors that are then reduced through temperature. The use of temperatures slightly above the glass transition temperature (T_g) during the thermal treatment allow to fix the nanoparticles, colouring the glass surface.

The colouration and the distribution of the metals in the surface region of the glasses are evaluated through UV-Visible Spectrometry and Rutherford Backscattering Spectrometry. Scanning electron microscopy is used for assessing morphology and sizes of the nanoparticles. The quantitative analysis of the elemental composition of the coloured glasses is carried out by Particle Induced X-Ray Emission.

Expected Results

Pink and blue colours can be obtained from Au nanoparticles, yellow colour from Ag, and orange from a mixture of both Au nanoparticles and Ag nanoparticles. The Ag colour intensity in glass is easily controlled through the number of layers while in the case of Au this variable influences not only the colour intensity but also the tone.

From the preliminary results there is a clear indication of the influence of Sn on the nucleation and growth of metal nanoparticles and consequently on the diffusion process in the glass matrix as well. Studies on the determination of the extension of this influence are under development.