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FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

Department of Chemistry

How smart is a Smart Window?

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requimte
rede de química e tecnologia

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Objectives

When no electric field is applied to a PDLC of a Smart Window, the liquid crystal molecules would be randomly oriented and the PDLC is opaque. This opacity is due to a dispersion of the incident light (OFF state). When an electric field is applied, the liquid crystal molecules will be align parallel to the field, possessing only one average refraction index that can match with the refraction index of the polymeric matrix, turning the cell transparent (ON state).
The permanent memory effect refers to the existence of two distinct transparency states: state B when an electric field is applied across the film and state C which corresponds to a high transparency state even after the applied voltage has been switched off. This memory state is stable for a long period of several months at room temperature.

Methodology

Polymer dispersed liquid crystal (PDLC) was prepared by polymerization-induced phase separation (PIPS). The long chain methacrylate and dimethacrylate monomers (matrix) and the liquid crystal were mixed together at room temperature until the mixture became homogeneous. The mixture is cured by thermal or photo polymerization resulting liquid crystal domains dispersed in a polymer matrix. The samples were prepared introducing the mixtures by capillary into 20 μm thick ITO coated glass cells. Detailed characterisation of monomers and films will be performed by elemental analysis, spectroscopy (NMR, FTIR), microscopy (SEM, POM), thermal properties (DSC) and electro-optical measurements.

Expected Results

In these PDLCs with permanent memory effect is possible to **write** information (applied voltage), to **read** the written information (in a digital way, opaque or transparent states) and **erase** information by increasing temperature and converting the device into the initial opaque state. On the other hand, PDLCs with permanent memory effect permit to switch the transparency and keep the new state without spending any more energy. They are lower power consumption and environment friendly new kind of digital memories. The switching properties of the PDLC films depend on some variables, the size and the shape of the LC domain, the microstructure of the polymer network and molecular interactions between the LC material and the polymer network (anchoring strength). These variables, among other factors, can be controlled in part by the polymerization method.

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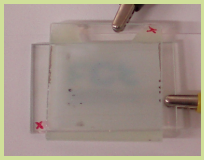
OFF State

A 

ON State

B 

OFF State

C 

OFF State, T>70ºC

C'=A