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FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

Department of Materials Science - CENIMAT / I3N

Structural colours in cellulose

Polymeric and Mesomorphic Materials Group
at DCM/FCT/UNL and Cenimat/I3N

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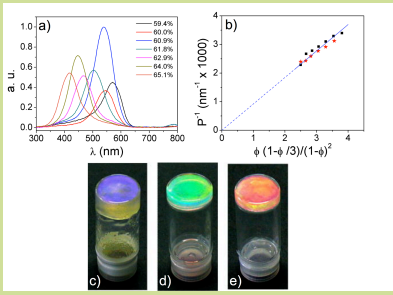
• Technological Chemistry degree, FC-UL, 1998.
•PhD in Chemical Engineering, IST/UTL, 2006.

• Current Research Interests: Polymers, Cellulose, Liquid crystals; photonic structural gratings.

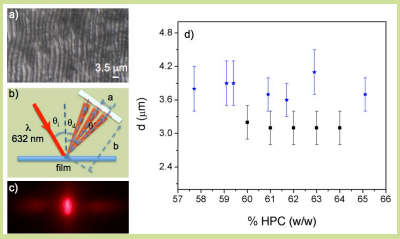
Objectives

"Structural colours in cellulose: Sculping the flow of light". The aim of this work is to synthesise and characterise new cellulosic-inspired photonic structures that form the basis of future optical devices. Cellulose is the core constituent of plant cells. Due to its chirality periodic helicoidal structures can be obtained with a pitch comparable to the visible light. Films and fibers were obtained from these systems by our group showing unique optical and photoresponsive properties. The surface topography of such films shows striations giving rise to an angular colour variation, which mimics the diffraction gratings found on flower petal surfaces. Natural structural colours in the animal kingdom have been investigated in detail. In contrast, little research has been devoted to the study of photonics structures in the plant world. This work is supervised by Professor Doctor Maria Helena Figueiredo Godinho.



Methodology

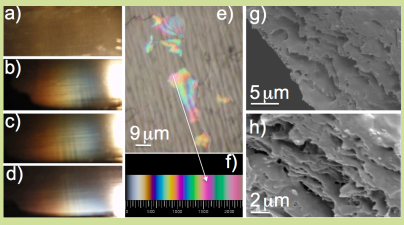
1- Syntheses of different cellulose derivatives with hydrophobic or hydrophilic molecules by chemical reaction with available hydroxyl groups from anhydroglucose units of the cellulose backbone.
2- Static and tunable one-dimensional photonic structures. Coloured films from cellulose liquid crystal solutions will be obtained.
3. Microfabrication of photonic structures with higher dimensionality.
4. Mimicry of plant cells by cellulose derivative systems.
5. Fine-tuning of the optical properties of liquid crystalline cellulosic structures and relation with plant structural colours in order to develop new photonic sensors.
6- The correlation between the pitch of the precursor lyotropic solutions and the diffraction gratings periodicity will be established.

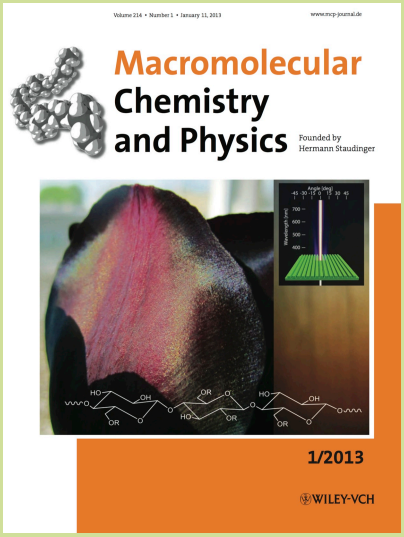


Expected Results

The originality of this work comprises the following main aspects:

- Preparation of new photonic structural gratings from cellulosic materials.
- Control of optical properties by tuning amplitude and frequency of surface striations.
- Understanding the relationship between molecular structure and development of modulated surface structures and their optical properties.
- Raising and study relevant fundamental material science questions regarding the relationship between the structural liquid crystalline parameters and the appearance of photonic diffraction gratings in solidified cellulosic films and the petals of plants.





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