



Structural Color and Sensing

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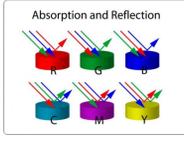
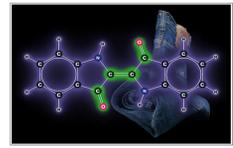
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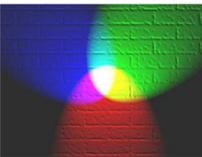
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The Color of Things

The color of things is often induced by pigments or dyes, which absorb certain wavelength and reflect of others.

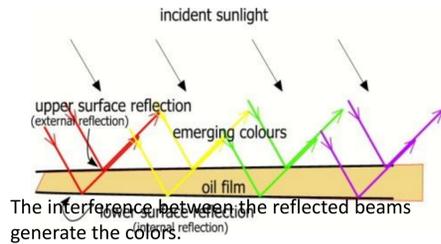
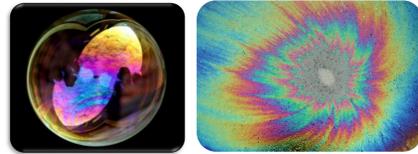


The color we perceive also depends on the incident light.



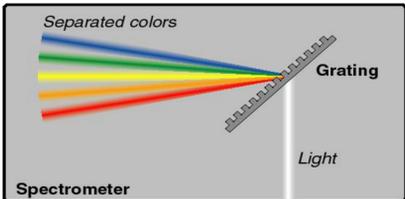
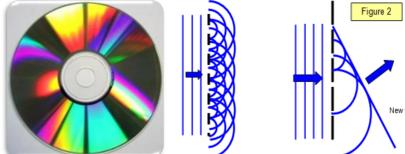
Some Colors do not arise from the properties of a material, but from its *shape*, which can cause InTERFERENCE< DIFFRACTION, and REFRACTION, generating the color.

INTERFERENCE



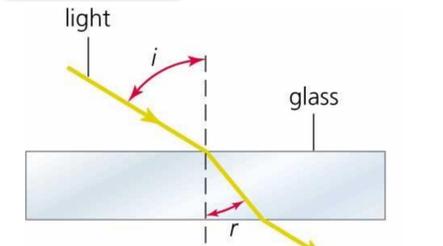
The interference between the reflected beams generate the colors.

DIFFRACTION



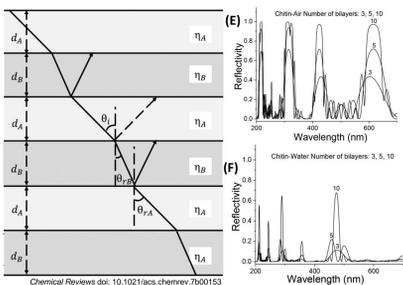
The interference on beams reflected from obstacles of size comparable with the wavelength.

REFRACTION



Variation of light speed in a media different refractive index.

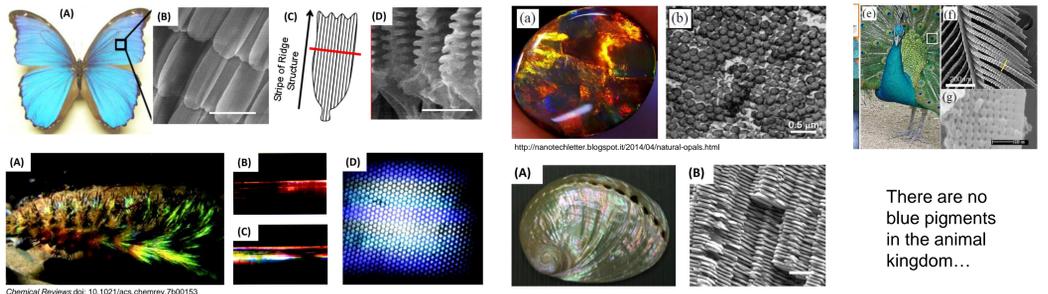
Structural Colors in Nature



Nature developed complex *microshapes* capable of reflect, refract and diffract light.

When light hit this structure iridescent colors arises. Butterflies, peacocks feathers, and opals are some examples.

This color can be detected as a peak of reflectance in their spectrum. This peak is called the Photonic Band Gap.



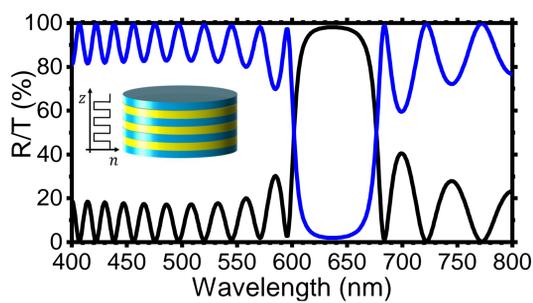
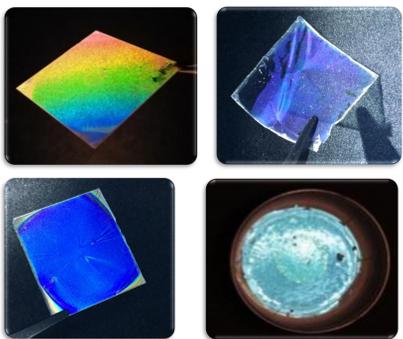
There are no blue pigments in the animal kingdom...

Photonic Crystal Sensors

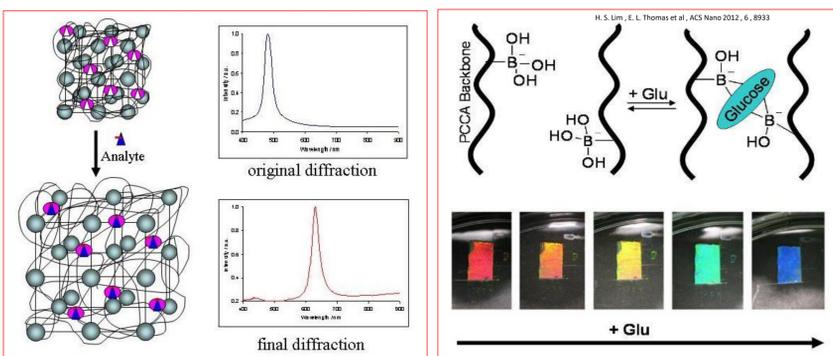
Synthetic Photonic Crystals (PhC) mimic structural colors using a lattices of materials with different refractive index.

The interfaces between the lattice media reflects and refracts the incident light. All these light beams interfere providing the color to the PhC surface.

The color depends on the materials that compose the lattice and its periodical path.



Penetration of molecule within the lattice, can induce variation of D and n_{eff} , thus modifying the PhC color. This response has been widely used to allow colorimetric sensing device, here are some examples:



Polymer opaline structures (3D PhC) can be opportunely functionalized to detect glucose in liquids. This systems can be used for everyday measurement of glucose concentration in human saliva and tears.



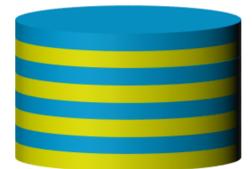
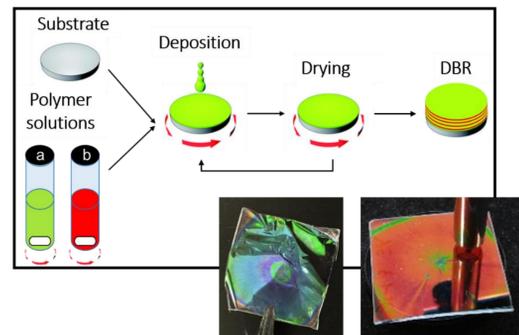
Polymer PhC sensors are able to disentangle different analytes without chemical labelling. These results promise new label-free naked-eye sensors suitable in both industrial and urban environment.

Our Work

Volatile Organic Compounds are toxic chemicals released in air by industrial and urban activities. Current technologies do not allow their qualitative and extensive assessment.

Polymer multilayered vapor sensors are promising low-cost, sensitive and selective lab-on-a-chip detectors that are easy to operate and do not require additional instrumentation.

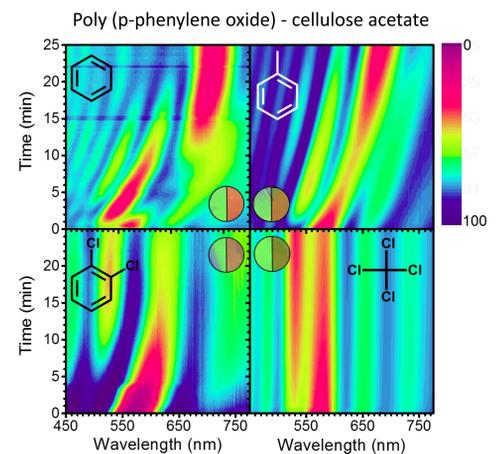
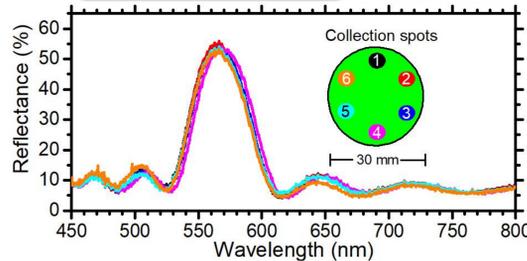
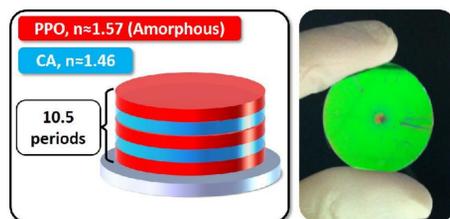
At the lab scale polymer sensors are fabricated by spin-coating...



.. But large area polymer multilayers are also fabricated industrially via co-hextrusion.



When exposed to vapors, the analyte penetrates within the polymers and swells them, varying the lattice parameters, and thus the multilayer spectrum.



Lova, P. et al. *Appl. Mater. Interfaces* 2016, 8, 31485-32082.

- Spun-cast polymer multilayered PhCs show high sensitivity to vapor analytes.
- The different molecular transport kinetic within the polymers allow label-free selectivity.
- The kinetic of the optical response can be related to diffusion kinetic of the analytes.

Festival della Scienza

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Contatti



UNIVERSITÀ DEGLI STUDI DI GENOVA



SYNCHRONICS

EU MSCA ETN on SupramolecularY eNgeered arCHitectures for optoelectRONics and photONICS

