Structural Coloration in Textiles

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Photonic Crystals 1D
Morpho butterfly
Photonic Crystals 1D
Morpho butterfly

The pigmentation in the scale absorbs the extraneous green to red light and enhances the blue colouring.
Photonic Crystals 2D
Mallard duck

doi:10.1038/srep04718
Photonic Crystals 3D diamond-based structure in the beetle L. augustus

http://physicsbuzz.physicscentral.com/2008_05_01_archive.htm
Photonic Crystals 3D diamond-based structure in the beetle L. augustus
Sensors made of Photonic crystals
- by humidity effect

Photonic Crystals 1D
Morpho butterfly

Photonic Crystals 3D
beetle Tmesisternus isabellae

- at our lab:
  - wet
  - drying

Sensors made of Photonic crystals

- by temperature effect

- by chemical effect

- by pH effect

- others:
  . ionic species
  . pressure
  . biomolecules

In air

In ethanol
Monodispersed composite latex spheres of poly-(styrene-methyl methacrylate-acrylic acid) (P(St-MMA-AA)) were synthesized by soap-free emulsion polymerization in a three-necked flask equipped with a reflux condenser and a mechanical stirrer.

The mixture was stirred at 70 °C in \(N_2\) atmosphere for 5 h to obtain a homogeneous particle diameter of \(\sim 380\) nm.
Nanophotonic Crystals
Size Control parameters

To make larger spheres:

a. use a bigger concentration of monomer,
b. use a lower temperature, or

![Image of nanospheres with dimensions]
c. use less initiator.
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Nano-photonic crystals were applied by:
- Deposition method

Momodisperse \( \text{P(St-MMA-AA)} \) poly-(styrene-methyl methacrylate-acrylic acid)
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Color without pigment/dyes on fabric, by applying a coating with nanophotonic crystals
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Applying Nano-photonics Crystals to Textile

• How to improve washing durability?

A study is going on to improve washing fastness, without loosing the handle properties, applying mixture of polymers.
Nowadays challenges

• Can we give to the Nanophotonic crystals colour?
  YES, WE CAN -> We have done it!

• Can we “work” with several layers of color?
  YES, WE CAN
Nowadays challenges
Nowadays challenges
1. It is possible to obtain color using nanophotonic crystals

2. Nanophotonic crystals can be applied to textiles

3. It is possible to increase washing fastness of these colorful systems

4. Structural coloring is an innovative and ecological technology, which can reduce the environmental impact of traditional coloring processes.
Thank you for your attention

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