ABSTRACT

Bionic-Art stands for a new kind of investigation field in interdisciplinary cooperation between nanotechnology, biology and art via highly developed material techniques. The project structure.makes.colors deals with structural colors (i.e., physical colors based on nanostructured materials) that have a long history in science and art. Already the Old Romans put their glasses beneath the earth to obtain shiny marvellous colors via the decomposition of the surface through metal salts. Organisms exhibit a wide choice of iridescent colors: examples comprise the wings of the Morpho butterfly species, the feathers of the peacock and crystalline scales on the outer cell wall of the beetle Cetonia aurata. Structural coloration is due to the interaction of visible light on sophisticated nanostructures caused by five physical phenomena (and not by pigments, as in the generally known colors). Most of the structural colors change with the viewing angle – this is a phenomenon known as iridescence. The aim of the project is to develop a new tool respectively a novel technique to implement the nanostructures directly on the surface of the artwork to obtain multiple illusions from different viewing angles, awakening people from their every day illusion to improve the artist-public interaction. The project also serves as a start up to establish Bionic-Art as a new science field connecting different science subjects in the name of art to enforce creativity and knowledge exchange for their own benefits. By finding suitable materials and corresponding nanostructures we aim at developing a revolutionizing nanoprint tool with possible bonus properties such as colors reacting to variations in humidity, radiation or even music (slight air pressure variations). Imagine we color our lives with nanostructures yielding colors that change with their ecological environment, are never fading and may have high sustainability potential (depending on the material and the structures we choose). This would be a revolution compared to the potentially toxic chemical pigments currently used in so many instances. Bionic-Art is going to pave this way in an artistic way that causes joy to the audience and the artists! For more information contact: info.bionic.art@gmx.net

Bionic

Role model Nature

Structural colors

Scientific theories

Technical possibilities

Limitless application due to progressive state of the art developments scientific staff take responsibility of the direction!

Physics of Structural Colors

Structural colors ∆ LIGHT + Nano-STRUCTURE

3 important parameters:

• Refraction index
• Thickness in the range of the visible light
• Angle of incident light and angle of view

5 physical phenomena:

• Thin film interference e.g. soap bubble
• Diffraction grating e.g. compact disc
• Photonic crystals e.g. opal

Structural colors in Nature

FAUNA

FLORA

MINERALOGY

Arthropoda

understory Plants

Opal

Aves

in Rainforests

Bionic-Art

Morpho

Leaves, Fruits, Petals

- Chief Structure

M. sulkowsky

Image: Zobl S.

Image left side: Morpho didius Fiji free documentation license. Right side show SEM images of the structured ground scales of a) Morpho didius b) M. sulkowskyi, Kinoshita et al., 2008.

Image above shows a composition of selected structural colors in nature and of some the Nanostructure is shown with a Scanning electron microscope or Transmission electron microscope view.

Image above left side: Parides sesostris, Davis. On the right side: Detail of a Scale a) SEM images show photonic crystals, c) TEM image of a 50 nm section of a scale from a).


Material studies (Zobl et al., 2011, 2012.)

First steps have already been done to transfer structural colors: 4email images above show artificial synthesized structural colors by the Imperial Lithography and Casting Replication Technique. Common materials used for works have been investigated (Zobl et al. 2011.)

References:


Nachdruck erlaubt

Photonic crystals Molding the Flow of Light Princeton University Press, 2003, pp 400

The Artcraft is made by the enterprise LÖTZ, Witwe Lötz, Vienna (~ 1900). The iridescent colors are due to fumes of metal salts (arsenic and antimony) that were incorporated during the manufacturing process. The decomposition of the gas surfaces through compounds of chlorine generated the lustre (Randau, 1980). The green iridescent glass left with branch structured body, Ref. Pic.: Ploil, Lötz, vol. 1, p. 102, comp. no. 65, vol. 2, pp.88, 331, 420, 557, Image: August Lechner, fürbel etage, 2004.