Gebeshuber I.C. et al., Abstract for a Keynote Presentation at the 3rd Nanoscience & Nanotechnology Symposium, Bandung, Indonesia, 2010.

Correlating nanostructures with function: Structural colours in wings of a Malaysian beetle

Gebeshuber I.C.[1,2*], Matin T.R. [1], Menon P.S. [1], Shaari S. [1], Leong M.K. [3] and Majlis B.Y. [1]

[1] Institute of Microengineering and Nanoelectronics, Universiti Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor, Malaysia
[2] Institute of Applied Physics, Vienna University of Technology, Wiedner Hauptstrasse 8-10/134, 1040 Wien, Austria
[3] Crest Nano Solution (M) Sdn. Bhd., Jalan Puchong, 47100 Puchong, Malaysia
* Corresponding author: ille.gebeshuber@mac.com

Keywords biomimetics, natural nanostructures, structural colours

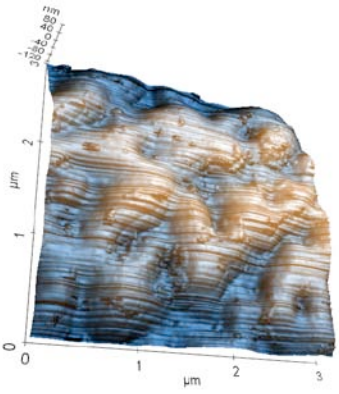
Structural colours refer to colours generated by nanostructures, with the characteristic dimension of the structures on the wavelength of the visible light (i.e., some hundreds of nanometers). Examples for structural colours are the colours of CDs and DVDs, the colours of soap bubbles or oil films on water (thin films), or the colours of certain butterfly wings (e.g., photonic crystals) [1,2].

Recently, we located a Malaysian beetle with iridescent structural coloration on its wings (see Figure). The generation of the colouration is still unknown, and there is no respective scientific literature available.

First attempts to investigate the nanostructures of the wing were performed with non-contact atomic force microscopy (AFM, Park Systems XE-100), with a cantilever of 40 N/m and a resonance frequency of 300.000 kHz. The AFM scans reveal three layers with structures with a diameter of several hundreds of nanometers (see Figure). This rules out thin films as the structures yielding the coloration.

Future research and correlation of various structures with function in this beetle wings will shed light on the contribution of these structures visible in the first AFM scans to the colouration. Structural colours produced by nature inspire novel approaches in man-made colours, via biomimetics (i.e., knowledge transfer from biology to technology) [3,4].

The Malaysian beetle with the iridescent structural colours on its wings.



*Nanostructures of the wing (non-contact mode atomic force microscopy, scan size 3*3µm^2).*

References

1. Matin T.R., Menon P.S., Shaari S. and Gebeshuber I.C. (2009) 'Photonic crystal micro- and nanostructures in iridescent butterfly wings', Proc. Nanotech Malaysia 2009 Conference, KLCC, Kuala Lumpur Convention Centre, Malaysia, October 27-29, 2009, p. 170-171, ISBN: 9789834 492106.
2. Gebeshuber I.C. (2009) 'Structural colors in biology and how these natural micro- and nano structures inspires current nanotechnology' (Plenary Address), Proc. International Seminar on Science and Technology 2009 ISST 2009 'The role of sciences and technology to improve the quality of life', October 24, 2009, Bukittinggi, Indonesia
3. Gebeshuber, I.C., Gruber, P. and Drack, M. (2009) 'A gaze into the crystal ball – biomimetics in the year 2059', *Proceedings of the Institution of Mechanical Engineers Part C: Journal of Mechanical Engineering Science*, Vol. 223, No. 12, pp. 2899–2918.
6. Gebeshuber, I.C. Stachelberger H., Ganji B.A., Fu D.C., Yunas J. and Majlis B.Y. *et al.* (2009) 'Exploring the innovational potential of biomimetics for novel 3D MEMS', *Advanced Materials Research*, Vol. 74, pp. 265–268.

Acknowledgements

The Austrian Society for the Advancement of Plant Sciences funded part of this work via the Biomimetics Pilot Project 'BioScreen'. Living in the tropics and exposure to high species diversity at frequent excursions to the tropical rainforests is a highly inspirational way to do biomimetics. Profs. F. Aumayr, H. Störi and G. Badurek from the Vienna University of Technology are acknowledged for enabling ICG three years of research in the inspiring environment in Malaysia. Crest (M) Sdn. Bhd. Is acknowledged for instrumental support.