**Biotemplating white beetle scales for isotropic high index photonic materials**

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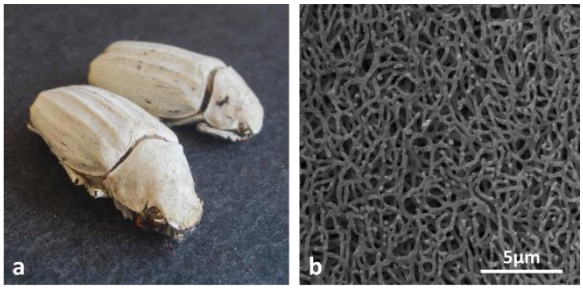
**Abstract**

Nanostructured dielectrics are omnipresent in nature and display magnificent permanent colors in addition to multi-functionality. Natural photonic nanostructures alter the spectral composition of impinging light, leading to enhanced photonic properties such as brilliant colors and strong light-matter interactions in particular manner for efficient light diffusers and reflectors [1]. In our experiments we study the white *Cyphochilus spp.* beetle as a biotemplate for optical materials design. The whole beetle body is covered with imbricated scales which exhibit an extremely efficient broadband reflectance [2]. The scale's structure is only 5-7um thin and is composed of a three-dimensional disordered assembly of highly intricated, low refractive index (n~1.55), chitin network rods. This remarkably optimized network acts as dense scattering media and is at the origin of its optical properties [3]. The replication of white beetle scales into $TiO_2$ (n~2.45) or Si (n~3.6) can be performed by means of a double inversion procedure. This process consists of a combination of atomic layer deposition, calcination and chemical vapor deposition to reproduce the white beetle polymer network. We expect that, upon replication of the structure into a material of higher refractive index, extremely efficient white optical diffusers can be realized approaching the regime of non-classical light transport or Anderson localization.




**a**. White beetles *Cyphochilus spp.* generally occurring in south-east Asia.
**b**. Scanning electron microscopy of the internal chitin network. Scale bar 5µm.

**References**

[1] N. Muller et al. Advanced Optical Materials, **2** (2014) 115-119
[2] M. Burresi et al. Scientific Reports, **4** (2014) 6075
[3] L. Cortese et al. Advanced Optical Materials, **3** (2015) 1337-1341