

The Beauty and Mystery of the Micro World

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Submitted: 05 Mar 2019; Accepted: 20 Mar 2019; Published: 01 Apr 2019

The beauty of these pictures is intriguing and fascinating by its asymmetric, exquisite and intricate patterns. What is it? Is it a product of a novel computer program or photographs of fine creations of nature? Neither of the statements is true. In fact, these are not art pictures, but real images of metal samples made with an electron microscope. Only some colours are added to the images to emphasize their resemblance to natural objects of our world: mushrooms, leaves of exotic plants, and seashells. The size of the samples is from tens of microns to 1-2 millimeters. They are produced via self-organization of nano-sized (1/million of a millimeter) wires growing on porous membranes under the action of electric current pulses. We have described comprehensively these volumetric (3D) sculptures as well as the experimental conditions for their fabrication in scientific journals [1- 5]. The most important parameters of the fabrication process (electrolyte composition, porous membrane, pulsed current modes) are specified, indicating when growing nanowires organize themselves in an inexplicable fashion into “sculptures” that show perfect resemblance to natural objects.

The authors have managed to isolate and photograph these synthetic objects using modern electron microscopes. Furthermore they have shown that the internal structure of the artificial metallic “seashells” is a volumetric multilayer network woven by nano-sized wires. Such antenna-like samples are expected to find applications in nano-scaled devices. Currently we produce such “sculptures” from various metals “by order”, examine them admiring their elegant forms and fascinating beauty. However, it is still a riddle. Why do they so closely resemble fungi, seashells and leaves? Does this mysterious self-organization have anything in common with the formation of the biological objects?



Figure 1

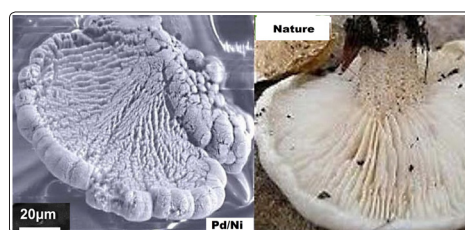


Figure 2

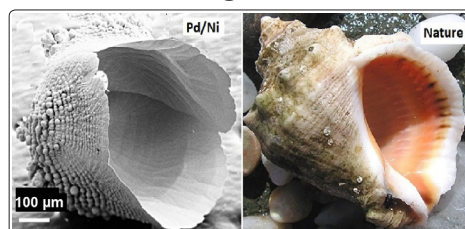


Figure 3

References

- Galina K Strukova, Gennady V Strukov, Evgeniya Yu Postnova, Alexander Yu Rusanov, Ivan S Veshchunov (2013) Mesoscopic Models of Plants Composed of Metallic Nanowires. *J of Bionic Engineering* 10: 368-376.
- Gennady V Strukov, Galina K Strukova (2013) Coming out of its shell: Biomimetic methods for metallic nanostructured mesoscopic model fabrication. *Materials Today* 16: 98-99.
- Strukova G K, Strukov GV, Egorov SV, Mazilkin AA, Khodos II et al., (2014) 3D-mesostructures obtained by self-organization of metallic nanowires. *Materials Letters*, 128: 212-215.
- Strukova G K, Strukov GV, Egorov SV, Rossolenko AA, Matveyev DV et al., (2017) Interaction of 3D mesostructures composed of Pd-Ni alloy nanowires with low-temperature oxygen plasma. *Materials Letters* 203: 68-72.
- Strukova G K, Strukov GV, Khodos II, Vitkalov SA (2018) Disintegration of nanostructured metals with the formation of nanoparticles in electron microscope. *Nano-Structures & Nano-Objects* 16: 104-109.

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