MESA+
INSTITUTE FOR NANOTECHNOLOGY
NanoLab Twente

SEM EXAMPLE

THE WORLD OF NANO SEEN BY SEM

BIOLOGICAL AND ARTIFICIAL NANOSTRUCTURES

Scanning Electron Microscopy (SEM) is a common technique to explore the surface morphology of a large variety of materials. Compared with a light microscope, the depth-of-field is significantly larger, allowing three-dimensional objects to be imaged with almost the same sharpness across the entire object. Moreover, SEM images look very similar in appearence as we would experience when we could see those objects with our eyes. A modern High-Resolution SEM (HRSEM) like the one at MESA+ NanoLab, can easily achieve a spatial resolution of the order of a nanometer. In this Application Note the use of SEM is demonstrated by showing 2 examples of objects with nanostructures; one is of biological origin, the other is created in the laboratory by nanotechnology engineers.

Nanostructures created by Mother Nature

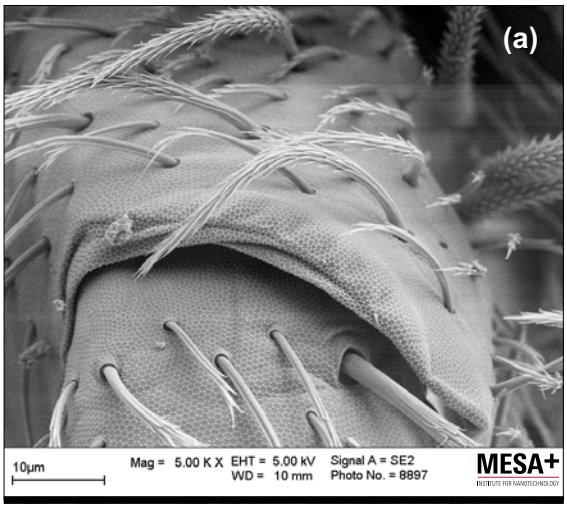
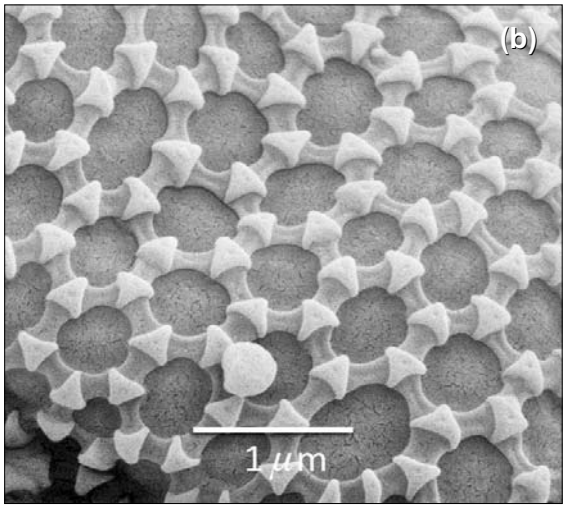


Fig. 1: (a) large field-of-view SEM image of part of the leg of an insect. At this relatively low magnification one can already distinguish a skin texture with a highly ordered pattern. By zooming into this skin, full detail is disclosed (b).



Nanostructures of biological origin, such as the sucker feet of a Gecko with which it can walk on a ceiling, often serve as an example for nanotechnologists in their attempt to create complex artificial nanostructures in the laboratory.

Artificial nanostructures created in the cleanroom by Corner Lithography

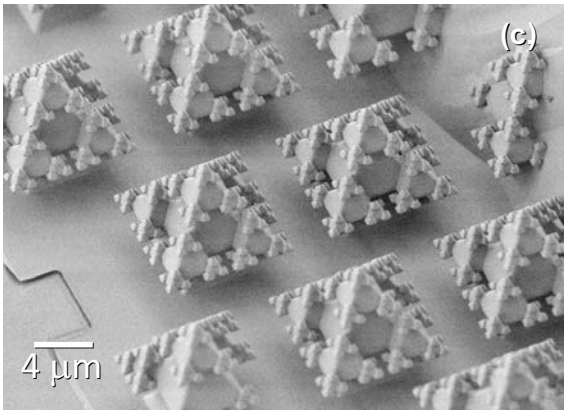
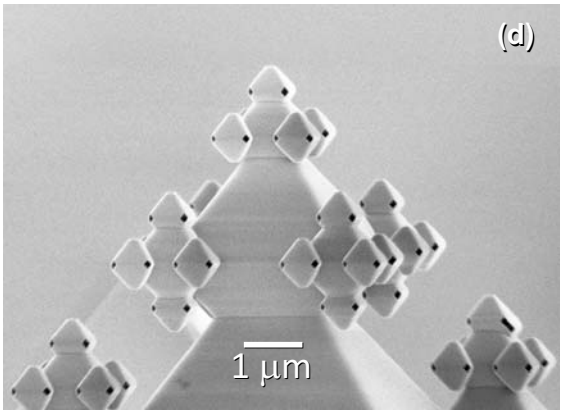


Fig. 2: nanotechnology engineers at MESA+ NanoLab were able to fabricate 3D fractal structures using so-called nanoscale anisotropic etching of single crystalline silicon [1]. The self-repeating octahedral units are shown in the large field-of-view image (c). HRSEM imaging, at 1 kV acceleration voltage, shows in more detail the tiny structures (d). Notice the large depth-of-field. HRSEM analysis proved to be of tremendous value for the engineers [1].



[1] Berenschot, E.J.W., Jansen, H.V., Tas, N.R., *„Fabrication of 3D fractal structures using nanoscale anisotropic etching of single crystalline silicon“*, J. Micromech. Microeng. 23 (2013) 055024 (p. 10), doi:10.1088/0960-1317/23/5/055024. ISSN 0960-1317.