Nanoporous Metallic Networks – A new class of materials

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Metallic nano-structures are well-known to exhibit unique optical properties[1]. It is attributed to excitation of surface plasmons (SPs), coherent oscillations of the metal's free electrons, which lead confinement of the electromagnetic (EM) field at their vicinity. The geometrical parameters of the metallic nano-structures (particles or cavities) determine their EM enhancement and confinement at specific frequencies. It is appealing to think about a universal plasmonic device, in which a rainbow of plasmonic modes at different frequencies will be excited at different areas and will harness the EM field. Furthermore, one would like to translate their unique optical phenomena they carry into a large-scale and by that extend their potential application. However, even nowadays technological endeavors cannot be answered by state-of-the-art nanofabrication routes, because it demands fine structures at the nano scale over a large scale piece[2].

We introduce a large-scale piece of metal with a nanoscale architecture of a three-dimensional (3D) continues network with unique optical properties[3]. The network is made of interconnected metallic nano-sized ligaments of about 50 nm and connective percolating (open-cell) nano-pores. Such 3D metallic networks are colored similar to solution dispersed metallic silver and gold nanoparticles. Moreover, thick films of about microns exhibit high optical transparency and electrical conductivity. We characterize the unique opto-electronic properties of such metallic nano-architecture networks, which are named 'Netals'[4].

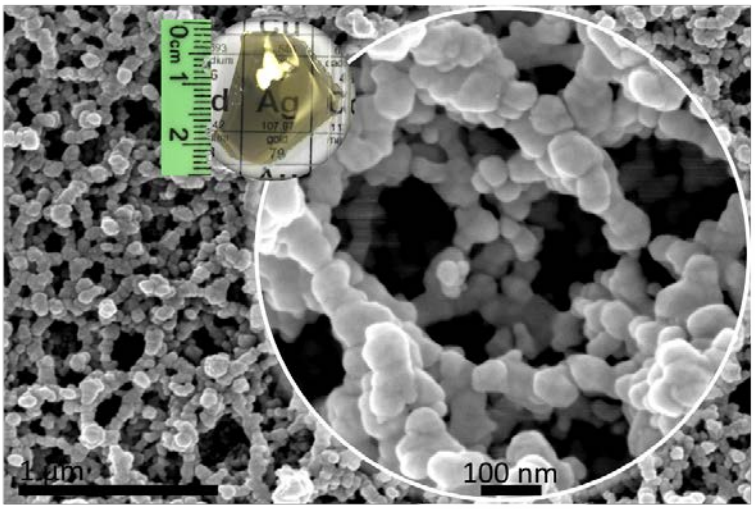

Fig. 1 scalable nanoporous metallic network made of silver.

The metallic networks (Netals) exhibit a strong nonlinear interaction with light and indicate a large fraction of hot-electrons generation. These hot-electrons are available to derive photocatalytic processes.

References:

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