## OPTICAL PROPERTIES AND GROWTH OF 3D METALLIC NETWORKS

Racheli Ron<sup>1</sup>, Adi Salomon<sup>1</sup>

Institute of Nanotechnology and Advanced Materials (BINA), Department of Chemistry, Bar-Ilan University, Ramat-Gan 5290002, Israel. Rachel.ron@biu.ac.il

## Summary

Nanoporous metallic networks are 3D solid structures made of nano-size ligaments and pores.

Since porous metals do not naturally exist in Nature, the fabrication technique strongly affects their properties. Herein we present growth of 3D nanoporous metallic networks by means of physical vapor deposition (PVD) on nanoporous and electrostatic silica substrate. The overall large-scale size of the metallic networks allows them to connect the nano-world into the macroscopic world.

The suboptical wavelength sizes of both particles and voids provide the networks with interesting optical properties. For example, these networked-metals ("Netals") introduce distinct colors which are different from the corresponding bulks, and are attributed to surface plasmon excitations. The plasmonic behavior of 3D nanoporous silver networks was resolved by means cathodoluminescence (CL) measurements showing a multimode nature not only from different locations at the network, but also from along a single ligament. In addition, silver networks introduce a broad nonlinear optical response coming into expression as intense second harmonic generation (SHG) emission. These optical properties as well as their high surface area, purity and permeability of guest materials make the 3D metallic networks appealing from both fundamental-scientific and technological aspects as they can be applicable for photonics, catalysis, sensing, and renewable energy.

## **References:**

- 1. Ron R., Gachet, D., Rechav, K., Salomon A. Direct Fabrication of 3D Metallic Networks and Their Performance. *Adv. Mater.* 1604018 (2016).
- 2. R. Ron, E. Haleva, A. Salomon, Nanoporous Metallic Networks: Fabrication, Optical Properties, and Applications. *Adv. Mater.*, 1706755, (2018).
- 3. R. Ron, O. shavit, H. Aharon, M. Galanty, A. Salomon, Second Harmonic Generation from 3D Nanoporous Metallic Networks. *arXiv:1805.00761*,(2018).