Nanoporous Metallic Networks: A New Class of Materials

Adi Salomon
Racheli Ron

BINA nano-center, Bar-Ilan University, Ramat-gan, Israel

Adi.salomon@biu.ac.il

Nanoporous metals are artificial and therefore their properties are a direct result of the preparation strategy. Practically, all the current available preparation techniques are multistep, and the resulting nanoporous metal contains foreign additives which eventually govern their optoelectronic properties and may deteriorate their performance. Dealloying, sacrificial templating and colloidal chemistry are the most common strategies use to fabricate nanoporous metals. The inner architecture of nanoporous metals consists of random sizes and shapes of both particles and holes. Consequently, these metallic architectures are able to interact with the entire solar spectrum through excitation of surface plasmons (SPs), a collective oscillation of the metal's free electrons. In a context of photo-catalysis, metallic nanostructures with a characteristic length smaller than 30 nm are important because of the high probability to excite charge carriers upon SPs decay. These excited carriers may be transferred to species in proximity and drive chemical transformations. Therefore, assembly of metallic nanoparticles (NPs) into pure nanoporous three-dimensional (3D) networks is valuable for many applications, while posing a significant challenge.

The resulting networks have distinct colors, different from the corresponding bulks, depending on the type of metal and the network thickness. The large-scale networks are transparent, flexible, pure, and show indication for hot carriers generation and photo-catalytic activity upon white-light illumination.

Those metallic networks bridge the nano world into the macroscopic world and therefore may pave the way for novel materials with unique opto-electronic properties.

I will discuss the method we develop to reach those large scale metallic networks, as well their linear and nonlinear optical properties.

References

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[2] R.Ron, A.Haleva, and A. Salomon. Advanced Materials, **2018**, under revision

Figures

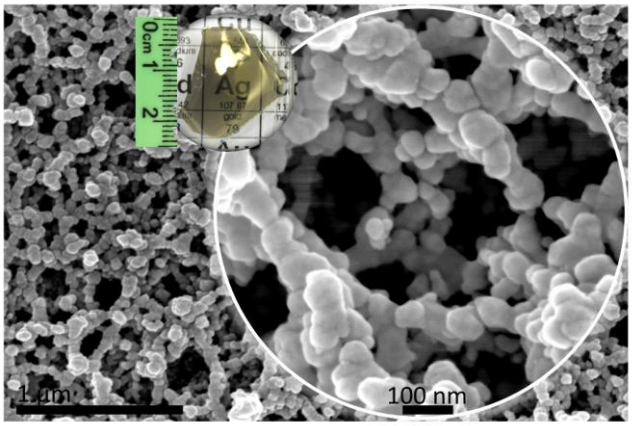

Figure 1: Large-scale nanoporous silver network.