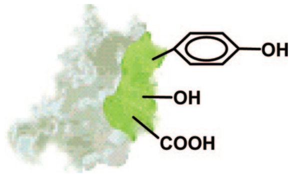
Bacteria: Silver Bullets for Nano-production

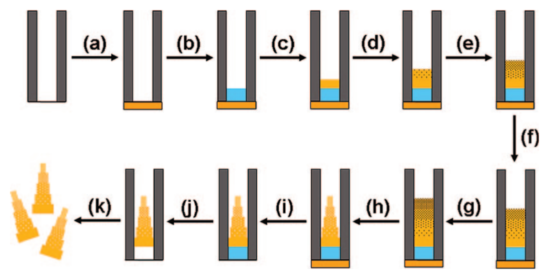
Several earlier research teams discovered biological means of producing Ag nanoparticles in various bacterial and fungal species. However, most of these investigations stopped at the phenomenological level before identifying the biomolecules involved in the synthesis of Ag nanoparticles. After recently using an extract of *Chlorella vulgaris*, a unicellular green alga, to produce Au nanoparticles, Xie *et al.* (p 429–439) studied the same bacterial extract with Ag. The team took advantage of the extract's reducing and shape-directing capabilities to produce large quantities of Ag nanoplates using a simple room-temperature, one-pot synthesis. Further study showed that Tyr residues were the agents responsible for bioreduction, and carboxyl groups in Asp and/or Glu were primarily responsible for the anisotropic growth of the Ag nanocrystals. The researchers suggest that their findings can potentially bridge the divide between biological synthesis and biomemietic synthesis of Ag nanomaterials, which can lead to new methods for biomimetic synthesis of other noble metals.



Nanowires, Made to Order

Nanowires are critically important building blocks for nanotechnology. An attractive and versatile route for preparing nanowires involves electrodeposition into cylindrical pores or a host porous membrane template, followed by dissolution of the template. Though this template-assisted electrochemical synthesis provides a convenient and reproducible method for the preparation of nanowires of various sizes and compositions, it restricts the resulting nanostructures to a cylindrical shape with a uniform diameter. To raise the bar, Laocharoensuk *et al.* (p 403–408) used a novel method to fabricate tailored Au nanowires in shapes that resemble barbells, step-cones, regular cones, and bones.

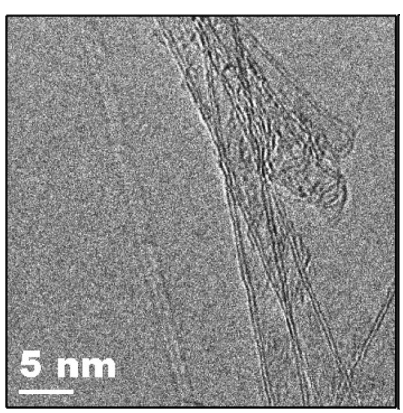
Their new protocol relies on sequentially depositing alloy segments of different Au/Ag ratios from plating solutions and etching away the Ag components. The researchers report that changing the alloy composition through controlled plating conditions allows remarkable control of the shape and dimensions of the resulting wires. For the multistep shapes, such as barbells and step-cones, different diameters result from the larger void spaces formed between the nanowire and the template for alloy segments with a higher Ag content. These spaces form when free Au atoms released during Ag dissolution diffuse toward the Au-rich center. Using the same idea, the team created cone- and bone-shaped nanowires by gradually changing the composition of a flowing plating solution. The researchers suggest that this versatile method could be adapted to create other nanocale objects with a wide variety of shapes and dimensions.



Spicing Up Double-Walled Nanotubes

Double-walled carbon nanotubes (DWNTs) fall in between the more commonly studied single-walled nanotubes (SWNTs), which consist of a single cylinder, and multiwalled nanotubes (MWNTs), which consist of multiple concentric cylinders. DWNTs consist of just two concentric cylinders of rolled graphene, a structure that imparts unique electrical and mechanical properties with potentially useful applications. Applications based on the electrical properties of all three types of nanotubes strongly depend on the tubes' diameter and helicity, as well as parity. Several groups have reported doping SWNTs and MWNTs with nitrogen and boron and characterizing the resulting materials. However, little is known about the characteristics of DWNTs doped with either of these elements.

Based on this, Panchakarla *et al.* (p 494–500) synthesized and characterized N- and B-doped DWNTs with respect to composition and structure. Using a variety of dopant precursors and catalysts, the team created the doped DWNTs using temperatures in excess of 950 °C. These high temperatures appeared to produce more DWNTs (>90%) with a lower fraction of SWNTs. Once the N- and B-doped DWNTs were synthesized, the team used both transmission electron spectroscopy and Raman spectroscopy to characterize the size and spectral properties of nanotubes in the different DWNT samples. They found that, besides affecting the G-band in the Raman spectra, N- and B-doping appeared to affect the proportion of semiconducting nanotubes. These findings, though preliminary, shed light on this unusual class of carbon nanotubes.



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