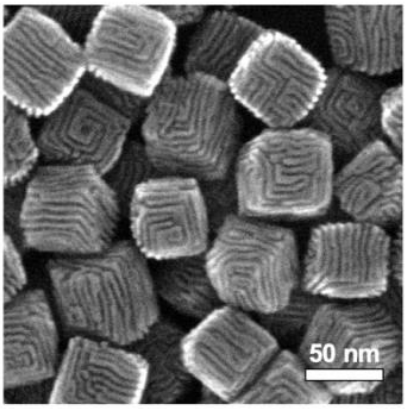
UNIVERSITY OF WATERLOO

TECHNOLOGY SUMMARY



Tunable Nanoscale Corrugated Metal Patterning on Metal Nanoparticles and Thin Films

Background

Metal nanoparticle size, overall shape and geometrical surface structure often plays a role in determining physicochemical properties, thus it is critical to find fabrication techniques with high precision and reproducibility that can create these geometrical parameters. While size and shape control in metal nanoparticle synthesis has been extensively studied, surface morphology control remains elusive. Thin metal films with well-defined surface roughness are required for several applications but current lithographic techniques are expensive and require specialized equipment. Tunable synthetic methodologies to create well-defined surface nanotextures on metal nanoparticles or extended surfaces generally remain a challenge.

Description of the invention

The present invention is an aqueous chemical patterning method for creating 1.5-2.3 nm grooves of tuneable depth (from sub-nm to tens of nm and above) in metal and metal alloy nanoparticles and thin films during their formation. The corrugated patterning results from performing a metal reduction with highly concentrated suspensions of the precursors in the presence of commercially available cationic surfactants causing the surfactants to self-assemble into worm-like micelles under the reaction conditions. This technology also enables the creation of mesoporous metal particles and films with a pore gap size corresponding to the minimal distance between two micelles.

Advantages

The technology provides a low-cost, scalable and sustainable alternative to the current expensive and tedious techniques such as nanolithography or electrodeposition. Three-dimensional patterning of metal nanoparticles or thin films with perforations allows to drastically increase the surface-to-volume ratio of a material.

Potential applications

This method can be used to create metal nanoparticles or metal films with nanometer sized grooves of tunable depth which have a wide range of applications. Some of the most promising are listed below:

- Catalysis
- Sensing
- Surface enhanced spectroscopy
- Drug delivery and theragnostics
- Current collectors in batteries

Reference
WatCo 10233

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Stage of development
Proven Prototype &
Ongoing Development

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