Making Nanostructured Porous Hollow Spheres with Tunable Structure

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SUMMARY

UCLA researchers in the Department of Chemical Engineering have developed a novel method of preparing inorganic nanospheres with porous hollow interiors.

BACKGROUND

Fuel cells are a promising alternative to combustion and are one of the cleanest and most efficient technologies for generating electricity, with the market for fuel cell electrodes and electrocatalysts of over $430 million in 2017. In these cells, the most effective catalysts for converting oxygen and hydrogen into electricity are platinum-based, resulting in prohibitively high costs and limiting their applications. One approach is to prepare novel catalysts that use less platinum and/or exhibit higher activity, such as nanocatalysts or alloys, in order to decrease costs.

INNOVATION

Professor Lu and coworkers have developed a novel aerosol-based method for preparing nanostructured spherical particles with porous hollow interiors. To produce well-ordered spheres, materials such as organic ligands are used as permanent or removable structural templates. This approach can be applied to a variety of elemental metals, including nickel and platinum, in order to synthesize particles with tunable properties. These nanospheres with high surface area and internal void volumes have wide applications in catalysis, sensing, energy conversion and storage, and drug delivery.

APPLICATIONS

- Catalysis
- Fuel cells
- Energy storage devices
- Solar cells
- Drug delivery

ADVANTAGES

- Lower cost catalyst (lower platinum requirements)
- Platform technology for various elemental metals
- Tunable properties
- Structural organic ligands can be removed after fabrication

STATE OF DEVELOPMENT

Metal nanoparticles have been demonstrated using nickel, platinum, palladium, and copper. Ni particles demonstrate increased hydrogen storage capability.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,573,194	02/21/2017	2011-800
United States Of America	Issued Patent	8,840,816	09/23/2014	2011-800
United States Of America	Issued Patent	8,728,361	05/20/2014	2011-800
China	Published Application	102309950A	01/11/2012	2011-800

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Metal-carbon composites, metal-organic ligand, porous, hollow, spherical nanostructure, aerosol

CATEGORIZED AS

- **Energy**
  - Other
  - Storage/Battery
- **Materials & Chemicals**
  - Composites
  - Nanomaterials
  - Polymers
  - Storage
- **Medical**
  - Delivery Systems
- **Sensors & Instrumentation**
  - Other

RELATED CASES

2011-800-0

Additional Patent Pending

RELATED MATERIALS

- Xiao, Q., Sohn, H., Chen, Z., Toso, D., Mechlenburg, M., Zhou, Z. H., Poirier, E., Dailly, A., Wang, H., Wu, Z., Cai, M. and Lu, Y., Mesoporous Metal and Metal Alloy Particles Synthesized by Aerosol-Assisted Confined Growth of Nanocrystals, Angew. Chem. Int. Ed., 2012.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Voltage-Responsive Coating for Lithium-Sulfur Battery
- Highly-Stablized Nanocapsules for siRNA Delivery
- Hierarchially Porous Carbon Particles for Electrochemical Applications
- Hyperbranched Polyglycerol Encapsulated Proteins for Oral Protein Delivery
- A Method Of Making Carbon Coated Oxides As High-Performance Anode Materials
- Viral Vector Nanocapsule for Targeting Gene Therapy

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