Platinum-Based Nano-Cages for Fuel Cells

A method that allows for the creation of platinum (Pt) nano-cages to act as an enhanced catalyst for critical fuel cell reactions

Georgia Tech Inventors have developed a method that eliminates the drawbacks associated with the polycrystalline Pt shells. They have created Pt nano-cages by coating Pt, only a few atomic layers thick, on palladium (Pd) nanocrystals, followed by selective removal of the Pd templates via chemical etching. Measurements indicated that these nano-cages exhibited greatly enhanced activities and improved stability towards the oxygen reduction reaction compared to the standard commercial Pt/carbon catalyst.

Summary Bullets

- Reduce the cost of Pt-based catalysts due to ultrathin walls of nano-cages and optimized surface structure
- Technique successfully applied to variety of different Pd nanocrystal shapes: cubes, octahedra, decahedra, icosahedra, plates, nanorods, and nanowires to engineer surface structure
- ORR activity and durability of the Pt nano-cages are greatly improved compared to the commercial Pt/C catalyst due to the feasibility to use particles with larger sizes without compromising the specific surface area

Solution Advantages

- Reduce the cost of Pt-based catalysts due to ultrathin walls of nano-cages and optimized surface structure
- Technique successfully applied to variety of different Pd nanocrystal shapes: cubes, octahedra, decahedra, icosahedra, plates, nanorods, and nanowires to engineer surface structure
- ORR activity and durability of the Pt nano-cages are greatly improved compared to the commercial Pt/C catalyst due to the feasibility to use particles with larger sizes without compromising the specific surface area

Potential Commercial Applications

Use as a catalyst for both the oxygen reduction and hydrogen oxidation reactions in proton-exchange membrane fuel cells, as well as other catalytic applications.

Background and More Information

One of the fundamental reactions within a fuel cell is the oxygen reduction reaction on the cathode. The critical challenge for improving the commercial viability of fuel cells is making an advancement in the catalysts for this reaction. Currently, platinum is deposited in a monolayer to act as a catalyst. However, due to platinum's intrinsic high bond-disassociation and surface free energies, the monolayer tends to form polycrystalline shells due to the island growth mode.

Inventors

- Dr. Younan Xia
  Professor - Georgia Tech Department of Biomedical Engineering
- Lei Zhang
  Visiting Research Student - Georgia Tech Department of Biomedical Engineering

IP Status

: US10835955B2

Publications

, -

Images

Visit the Technology here:
Platinum-Based Nano-Cages for Fuel Cells