High Stability PtNiX-M Electrochemical Catalyst

Tech ID: 29292 / UC Case 2017-514-0

SUMMARY

UCLA researchers in the Department of Material Science and Engineering have invented a novel and highly stable platinum-based catalyst material for fuel cell technologies.

BACKGROUND

Platinum-based alloy materials (e.g., Pt-Ni, Pt-Co) have a higher activity (up to 90x greater) than commercial Pt-C materials for use as catalysts in fuel cells. However, their use up to this point has been limited due to stability issues. Nanomaterial crystals have been shown to have superior performance over single crystals, making them a leading material candidate. However, Pt-based nanostructures with both high catalytic activity and stability, which also have a reduced usage of scarce Pt, have remained a challenge.

INNOVATION

Researchers led by Professor Huang have developed an innovative and facile synthesis to introduce a transition metal (e.g., Cu, Co, Mn, Fe, Mo, Nb, W, Ta) to a PtNiN-based catalyst. After post-synthesis treatment, this novel catalyst showed significant improvement (2x) compared to the same catalysts without this treatment. This PtNiN-M catalyst uses a reduced amount of Pt and has an extended fuel cell device lifetime. Additionally, this material has outstanding activity and stability in membrane electrode assembly (MEA) based fuel cell tests.

APPLICATIONS

- Catalysis
- Fuel cell devices
- MEA fuel cell component
- Proton-exchange membrane (PEM) fuel cells

ADVANTAGES

- Facile synthesis to add transition metals to a PtNiN material
- High stability and activity
- Reduces the amount of noble metal used
- Extends the fuel cell lifetime
- Post-synthesis treatment improves catalytic activity

STATE OF DEVELOPMENT

This novel material has been synthesized at large scales (1 gram/batch) and has been tested in MEA-based fuel cell tests. More conditions for post-synthesis treatment, elemental effects, and Pt concentration will be further explored to optimize its catalytic activity.

PATENT STATUS

Patent Pending

RELATED MATERIALS

- X. Huang, E. Zhu, Y. Chen, Y. Li, C.-Y. Chiu, Y. Xu, Z. Lin, X. Duan, Y. Huang, A Facile Strategy to Pt3Ni Nanocrystals with Highly Porous Features as an Enhanced Oxygen Reduction Reaction Catalyst, Advanced Materials, 2013.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Platinum, Pt, Pt alloy materials, PtNiN, PtNiN-M catalyst, catalysis, high stability, high activity, high performance, post-synthesis treatment, fuel cells, membrane electrode assembly, MEA, proton-exchange membrane, PEM

CATEGORIZED AS

- **Engineering**
  - Engineering
  - Other
- **Materials & Chemicals**
  - Chemicals
  - Composites
  - Nanomaterials
  - Other
- **Nanotechnology**
  - Materials
  - Other
  - Tools and Devices

RELATED CASES

2017-514-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- High Performance Platinum-Based Catalyst Combined with Carbon Support Engineering
- Highly Durable and Active Fuel Cell Electro-Catalyst Designed with Hybrid Support

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