Platinum Oxide Nanoparticles For Electrocheical Hydrogen Evolution Influence Of Platinum Valence State

Tech ID: 33005 / UC Case 2020-259-0

BACKGROUND

Platinum remains a leading choice of catalyst for the Hydrogen Evolution reaction (HER) but because of its high cost and low natural abundance, it is critical to optimize its use. HER catalysts with reduced amounts of Pt would be of high value.

TECHNOLOGY DESCRIPTION

Platinum oxide nanoparticles of approximately 2 nm in diameter are deposited on carbon nitride (C3N4) nanosheets by thermal refluxing of C_3N_4 and $PtCl_2$ or $PtCl_4$ in water. These nanoparticles exhibit apparent electrocatalytic activity toward the hydrogen evolution reaction (HER) in acid. Interestingly, the HER activity increases with increasing Pt^{4+} concentration in the nanoparticles, and the optimized catalyst even outperforms commercial Pt/C, exhibiting an overpotential of only −7.7 mV to reach the current density of 10 mA cm^{-2} and a Tafel slope of −26.3 mV dec^{-1}.

Description unavailable

APPLICATIONS

Hydrogen evolution reaction in acidic conditions

Clean hydrogen production by electrolysis

ADVANTAGES

Maximizing Pt4+ ions relative to Pt2+ ions in nanoparticles results in a very high efficiency HER catalyst while minimizing the amount of platinum used.

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,767,602	09/26/2023	2020-259
United States Of America	Published Application	20230383425	11/30/2023	2020-259

RELATED MATERIALS

- Platinum Oxide Nanoparticles for Electrochemical Hydrogen Evolution: Influence of Platinum Valence State - 10/28/2019

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Hydrogen Evolution Reaction, Hydrogen Evolution Reaction Catalysts, Hydrogen Production by Electrolysis, Clean Hydrogen Production, Platinum Catalyst, Hydrogen Evolution Reaction Acidic Conditions, Platinum Nanoparticles

CATEGORIZED AS

- **Energy**
  - Hydrogen

RELATED CASES

2020-259-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Rapid Preparation of Electrocatalysts by Magnetic Induction Heating and Rapid Quenching
- Ru,N-Codoped Carbon Outperforms Platinum Toward Hydrogen Evolution Reaction In Alkaline Media By Atomically Dispersed Ruthenium
- Catalysis Of The Hydrogen Evolution Reaction Using Ruthenium Ion Complexed Carbon Nitride Materials

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