Hokkaido Univ. Technology

Electrode and control method of Overvoltage

Decrease of overpotential by surface structure

Overview

Hydrogen production by water electrolysis has attracted attention in terms of realizing carbon neutrality.

However, **large overvoltage (= overpotential) is a challenge that causes excessive degradation for the electrode in conventional electrodes**. To solve this challenge, optimization of the material composition of the electrode has been advanced, but it is not sufficient.

In the invention, as a new electrode design approach, the surface structure of the electrode (nano/micro structure) is calculated and designed in terms of introduction of the interaction with the electronic polarization of chemical reaction intermediates or the vibrational polarization of water molecules in water electrolysis. **It can reduce the overpotential and Tafel slope by applying above method successfully**.

The invention enables water electrolysis with low overpotential, and is expected to reduce power consumption and extend the life of the electrode.

Product Application

- Electrode for water electrolysis

IP Data

IP No. : PCT/JP2024/007889
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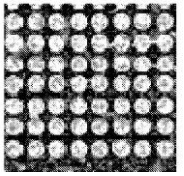
Admin No.: HK24-016

Features・Outstandings

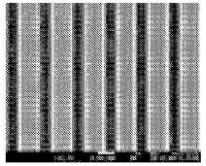


【**Nano** structure electrode for hydrogen electrode】

・Nano column on electrode

	Metal	Resonance energy / eV	Tafel slope* / mV decade^{-1}
Nano 1	Ag	1.33	**63**
Nano 2	Ag	0.98	**34**
Nano 3	Ag	0.84	**54**
Smooth (comp.)	Ag	-	**110**

*Overpotential required to increase current by one order of magnitude. (Electrode activity index.)



【**Micro** structure electrode for oxygen electrode】

・Micro stripe on electrode

	Metal	Resonant wavenumber / cm^{-1}	Tafel slope* / mV decade^{-1}
Micro 1	Ni/Fe	4180	**120**
Micro 2	Ni/Fe	3320	**40**
Micro 3	Ni/Fe	3040	**80**
Smooth (comp.)	Ni/Fe	-	**120**

⇒ Calculating and designing polarization energy, resonant wave number reduce the overpotential and Tafel slope

Contact

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