NEW METAL-FREE ELECTROCATALYSTS FOR FUEL CELLS

DESCRIPTION OF THE TECHNOLOGY

A new method has been developed to obtain **carbon materials** with excellent properties such as **electrocatalysts in fuel cells or metal-air batteries**. The process is based on the thermal treatment of polyaniline (or its derivatives) at high temperature and allows to obtain **metal-free** carbon materials with a high performance, in a very simple and fast way, and in a single-stage.

These novel materials are characterized by their excellent catalytic activity and selectivity in the oxygen reduction reaction in alkaline medium. They are very stable and resistant to methanol and carbon monoxide poisoning, and above all, they stand out for their low manufacturing cost, which it makes them promising candidates to **replace the current commercial platinum-based catalysts**.

MARKET APPLICATION SECTORS

This invention is framed in the **energy sector**, specifically in the area related to chemical transformations derived from the transfer of electrons produced in electrocatalysts. This technology makes it possible to obtain metal-free carbon materials for application as excellent electrocatalysts (cathode) in the **oxygen reduction reaction under alkaline conditions** in hydrogen or methanol low temperature **fuel cells**, or in **metal-air batteries**.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

The main advantages of this novel method are listed below:

- It uses low cost precursors.
- It does not require special equipment.
- They are synthesized in a **very simple way** and in a **single-stage** without using a template or sacrificial materials.
- The synthesis method has a **high yield**.
- **Low cost** of the synthesis method: manufacturing cost to obtain this type of materials is radically lower than current commercial catalysts.
- Synthesized carbon materials are **easy to handle**: they are dispersed easily in an aqueous medium at room temperature.
- They have an **excellent electrocatalytic activity** for oxygen reduction reaction in alkaline medium.
- They have a **great stability**, which it gives them a longer useful working time (durability) than current platinum-based electrodes of fuel cells or metal-air batteries.
- They are **resistant** to methanol or carbon monoxide **poisoning**.
- The oxygen reduction reaction has a **high selectivity**: it is carried out through a mechanism of four electrons whose final reaction product is water (with a production of reaction intermediaries lower than 5%).
- They are **environmentally friendly materials** because they are metal-free catalysts.
- They can be used as **electrodes** in **fuel cells** and **metal-air batteries**.
- They reduce the total cost of the fuel cell.
- These are major candidates to replace existing commercial platinum-based catalysts in alkaline medium.

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CURRENT STATE OF DEVELOPMENT

These novel electrocatalysts have been **successfully** synthesized at **laboratory scale**.

Kinetic parameters obtained for these new electrocatalysts, whose values are similar to those obtained by commercial platinum-based catalysts, are listed below: starting potential of the reaction = 0.94 V.; half-wave potential = 0.85 V.; limiting current density = 5.8 $mA \cdot cm^{-2}$; number of transferred electrons = 3.9 (by RRDE).

INTELLECTUAL PROPERTY RIGHTS

The present invention is protected by **patent application**:

- *Title of the patent: "Procedimiento de síntesis de materiales carbonosos para su aplicación como electrocatalizadores y material obtenido por medio de dicho procedimiento".*
- *Application number: P201830278.*
- *Application date: 21st March, 2018.*

COLABORATION SOUGHT

We are looking for companies interested in acquiring this technology for commercial exploitation through:

- **Patent licensing** agreements.
- Development of **new applications**.

Company profile sought: manufacturers of catalysts and electrocatalysts for fuel cells or metal-air batteries.

RELATED IMAGES

***Image 1**: electrocatalyst obtained with the new procedure.*

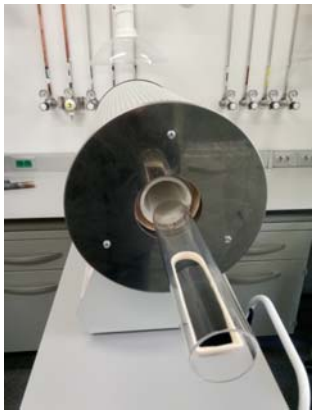

***Image 2**: furnace in which the new procedure is carried out.*

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