NEW PROCESS FOR THE MANUFACTURE OF ELECTRODES FROM SUPERPOROUS NANOSTRUCTURED CARBON MATERIALS

PATENTED TECHNOLOGY

CONTACT DETAILS:

Research Results Transfer Office-OTRI
University of Alicante
Tel.: +34 96 590 99 59
Email: areaempresas@ua.es
http://innoua.ua.es

ABSTRACT

Researchers from Alicante and Malaga University have developed a new process for the manufacture of electrodes from superporous nanostructured carbon materials.

The process here described uses electrospraying technique to deposit a suspension of a carbon material with a binder, over a current collector. This process greatly facilitates processing superporous nanostructured carbon materials due to its high efficiency and less complexities compared to conventional techniques.

The electrodes or microelectrodes obtained by this process are of great interest for their applications in energy storage or analytical sensors in commercial devices.

INTRODUCTION

In recent years, the interest on the use of nanostructured carbon materials as electrodes has greatly increased due to its great accessibility, high thermal stability, chemical and physical stability, and relatively low cost. They also have a high specific surface due to the presence of pores of small size (micro and mesopores), which size distribution can easily be modulated using different preparation methods. All these properties make the nanostructured carbon materials suitable for use as electrodes in various electrochemical applications.

Nanostructured carbon materials usually present very high apparent surface area, but the low particle size and their elevated reactivity become them into materials of complex handling, whose shaping into uniform deposits is normally a challenge. In this sense, an adequate conformation of these materials imply its mixture with a binder and a conductive promoter, in such a way to achieve a very thin paste over the current collector. The technology developed by the researchers is able to simplify considerably the manufacture process of the electrodes.

TECHNICAL DESCRIPTION

The present invention describes a method that allows manufacture electrodes and/or microelectrodes by selective deposition of superporous nanostructured carbon materials directly by electrospraying of a carbon material suspension with a binder on the current collector.

Electrospraying technique consists on the formation of a steady coaxial jet of the suspension by the action of the Electro-

Hydrodynamic (EHD) forces. The suspension is injected through two coaxial needles connected to a HV power supply. Under the action of the electric field, the compound meniscus adopts a conical shape (Taylor cone).

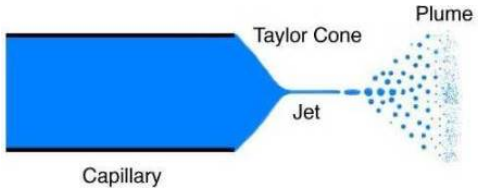

Figure 1. Taylor cone (Source: Wikipedia)

The first step consists on the preparation of a suspension of the superporous nanostructured carbon material, and all the compounds required for the electrode shaping (binder, conductive promoter,...)

Under the optimized experimental conditions, a thin jet is emitted from the tip of the Taylor cone above mentioned. Due to varicose efforts, the jet should break up into charged droplets of submicrometric sizes, which are composed of the carbon materials and the different additives.

These charged particles are moved selectively to the collector, in our case, the own electrode.

This process allows preparing a very thin and homogeneous layer of the active material over the electrode, in such a fast and simple way.

ADVANTAGES AND INNOVATIVE ASPECTS

COMPETITIVE ADVANTAGES

The method referred in this invention provides the following advantages:

- Solve the complexity and other problems existing in other procedures used to generate electrodes and microelectrodes.
- Carbon materials are selectively deposited, as homogeneous layers, with controllable thickness.
- The process has a high degree of reproducibility, particularly compared with the blade coating technique.
- Does not require subsequent pressing of the electrode to increase the degree of packing.
- Does not require a subsequent heat treatment at elevated temperatures.
- The use of the electrode as current collector increases the efficiency of the process, in terms of selectivity of the deposit on the electrode.

INNOVATIVE ASPECTS OF THE TECHNOLOGY

The process here described is simpler than those available nowadays. It reduces the number of necessary stages and his complexity to obtain electrodes from superporous nanostructured carbon materials at room temperature and pressure. Only it needs a later step of drying at low temperature to remove the used solvent.

The invention enables the manufacture of electrodes and microelectrodes for electrochemical and analytical applications, such as energy storage, or as analytical sensors in commercial devices.

CURRENT STATE OF DEVELOPMENT

At present the technology has been tested in the laboratories of the University of Alicante with successful results.

MARKET APPLICATIONS

The present invention belongs to the field of electrochemistry. Particularly, the invention enables the manufacture of electrodes and microelectrodes for electrochemical and analytical applications, such as energy storage, or as analytical sensors in commercial devices.

COLLABORATION SOUGHT

Companies are looked interested in acquiring this technology for his commercial exploitation by means of agreement of license

of the patent.

INTELLECTUAL PROPERTY RIGHTS

This technology is protected by a patent application.

- Patent title: “Procedimiento para la fabricación de electrodos o microelectrodos a partir de materiales carbonosos nanoestructurados superporosos mediante electroesprayado, electrodos o microelectrodos obtenidos mediante este procedimiento y usos para aplicaciones electroquímicas y analíticas”
- Number of application: P201531008
- Date of application: 10/07/2015

MARKET APPLICATION (4)

Pollution and Environmental Impact
Materials and Nanotechnology
Medicine and Health
Chemical Technology