Polymer Based High Surface Area Multi-Layered Three-Dimensional Structures

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,641,883	02/04/2014	2010-235

BRIEF DESCRIPTION

The field of the invention generally relates to methods of constructing high surface area structures using photoresist patterning in combination with electrochemical polymer deposition.The methods described herein can be used to create structures for a wide variety of applications including, but not limited to, micro-reactors, electrodes, and sensors (e.g., biosensors).

FULL DESCRIPTION

High surface area structures are utilized for variety of purposes such as increasing the rate of chemical and electrochemical reactions and enhancing the sensitivity of biosensors.High surface areas provide abundant places where absorption or reactions of interest can take place thereby increasing the reaction rate.Typical conductive high surface area structures sometimes involve carbon powders and nanotubes.While the use of micro-sized and nano-sized particles provides large surface areas, such an approach carries a significant disadvantage.In particular, there is a rise in resistance due to particle-to-particle conduction losses.A superior electrode structure would have a tailored geometry optimizing the trade-off between higher surface area and the decrease in resistance losses.

In this invention disclosure we propose a method for production of three-dimensional polymer based high surface area topologies that can be used as a basis for biosensors as well as for a variety of other applications where high surface area of controlled geometry is desired.

The basic principle for the invention is a property of lateral growth exhibited by the electroactive polymers during the deposition process. The method will produce three-dimensional high surface area conductive structures. In order to modify mechanical and electrical properties of the resulting structures, the pyrolysis can be used as either an intermediate or final stage of the process. The resulting conductive structure can also be used as a high surface area electrode for the deposition of the polymer-enzyme mix for biosensor applications.

SUGGESTED USES

The utility of the proposed design is to make a centrifugal fluidic disk (used for variety of applications such as diagnostics, synthesis, etc.) a modular platform consisting of user-defined arrangement of specific fluidic units for sample input and output, mixing, metering, analysis, unit interconnections. Thus the centrifugal fluidic platform becomes user-friendly, flexible tool for synthesis, purification, analysis, and diagnostics.

INVENTORS

- Kulinsky, Lawrence
- Madou, Marc J.

OTHER INFORMATION

CATEGORIZED AS

- **Biotechnology**
  - Other
- **Medical**
  - Devices
  - Other
  - Research Tools
  - Screening
- **Nanotechnology**
  - Other
  - Tools and Devices
- **Research Tools**

ADVANTAGES

Advantages of the proposed approach are:

creation of the high surface area three-dimensional conductive structures with the controlled geometry;

final electrical and chemical properties of the structures can be modified by using a variety of monomers and by using various dopants and enzymes added during the electrodeposition step;

final specific surface area can be controlled by variation of the number of layers deposited and by the modification of spacing and the cross-sectional geometry;

specific surface area can be increased further by the decoration of the resulting surfaces with nanoparticles;

high surface areas can be used in an enzymatic biosensor if enzymes are added during the deposition process;

the proposed technology gives flexibility to either produce an array of posts, a single extra layer of surface, or multiple layers of three-dimensional high surface area structures.

RELATED CASES

2010-235-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- LaserPack: A burstable liquid storage package for biological material storage and valve substitution
- Fabricating Crystallinity Unique Carbon Nanowires (~5nm) with Ultrahigh Electrical Conductivity
- Dissolvable Calcium Alginate Microfibers via Immersed Microfluidic Spinning
- FlexThrough: a recirculation mechanism for point of care, centrifugal disk-based microfluidic devices
- Low-Voltage Near-Field Electrospinning Enables Controlled Continuous Patterning of Nanofibers on 2D and 3D Substrates
- Stepwise Fabrication of Conductive Carbon Nanotube Bridges via Dielectrophoresis
- Guided Template Based Electrokinetic Microassembly (TEA)
- Flexthrough: A Recirculation Mechanism In Point Of Care CD Microfluidic Using Elastic Membrane

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