Highly Efficient Catalytic Microtube Engines

Tech ID: 21896 / UC Case 2011-286-0

BACKGROUND

Much recent attention has been given to self-propelled chemically-powered catalytic nanomotors. Among these, catalytic microtube engines are particularly attractive for practical applications due to their efficient bubble-induced propulsion in relevant biological fluids and salt-rich environments. Such powerful microengines are commonly prepared by top-down photolithography, e-beam evaporation, and stress-assisted rolling of functional nanomembranes on polymers into conical microtubes. While offering attractive performance, these methods' practical utility is greatly hindered by their complexity and related (clean-room) costs. Another approach involves sequential electrodeposition of platinum and gold layers onto an etched silver wire template but offers low yield and inferior propulsion behavior.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed fabrication methods and articles of manufacture relating to the low-cost, mass production of highly effiicient catalytic microtube engines based on membrane template electrodeposition. The invention's microrockets propel well in diverse biological fluids and can be used in diverse biomedical applications, e.g., lab-on-chip diagnostics, cell sorting, target isolation, targeted drug delivery, and microsurgery. This technology can also potentially be applied to oil exploration as well as cleaning up of oil spills.

In one example, highly efficient catalytic microtubular engines are synthesized rapidly and inexpensively using an electrochemical growth of bilayer polyaniline (PANI)/platinum microtubes within the conically-shaped pores of a polycarbonate template membrane. These mass produced microtubular engines are only 8 μm long, self-propelled at an ultrafast speed (of over 300 body-lengths s-1), and can operate in very low levels of the hydrogen peroxide fuel (down to 0.2 percent). The method can be used to synthesize microrockets with different diameters and lengths (e.g., 1-3 μm diameter, 4-20 μm length) and can be adapted for different multilayer materials and cone angles. Directional control of these microrockets has been demonstrated.

INTELLECTUAL PROPERTY INFO

This technology has a patent pending and is available for licensing and/or sponsorship.

RELATED MATERIALS

- First microsubmarines designed to help clean up oil spills. R & d Magazine, May 2 2012. - 05/02/2012
- Superhydrophobic Alkanethiol-Coated Microsubmarines for Effective Removal of Oil. M Guix, J Orozco, M Garcia, W Gao, W Sattayasamitsathit, A Merkoci, A Escarpa and J Wang. ACS Nano, 2012, 6 (5), pp 4445–4451 - 04/05/2012
- Highly Efficient Catalytic Microengines: Membrane Electrodeposition of Bilayer Polyaniline-Platinum Conical Microtubes, W. Gao, S. Sattayasamitsathit, J. Orozco and J. Wang, J. Am. Chem. Soc., 133 (2011) 11862.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,982,356	05/29/2018	2011-286
United States Of America	Issued Patent	9,879,310	01/30/2018	2011-171
United States Of America	Issued Patent	9,347,143	05/24/2016	2011-286

Additional Patent Pending

CONTACT
University of California, San Diego
Office of Innovation and Commercialization
innovation@ucsd.edu
tel: 858.534.5815.

OTHER INFORMATION

KEYWORDS

microrocket, micromotor, microtube engine, catalytic nanomotor, nanomachine, membrane template electrodeposition, lab-on-chip, cell sorting, target isolation, drug delivery, microsurgery, oil exploration, oil spill cleanup

CATEGORIZED AS

- **Biotechnology**
  - Other
- **Medical**
  - Delivery Systems
  - Diagnostics
- **Nanotechnology**
  - NanoBio

RELATED CASES

2011-286-0, 2011-171-0

University of California, San Diego
Office of Innovation and Commercialization
9500 Gilman Drive, MC 0910, ,
La Jolla,CA 92093-0910

Tel: 858.534.5815
innovation@ucsd.edu
https://innovation.ucsd.edu
Fax: 858.534.7345