Method for TiO2 nanotubular coatings on 3D structures

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BACKGROUND

U.S. demand for implantable medical devices is forecasted to increase 7.7% annually to $52 billion in 2015.

With this growth, there is a need to decrease device failure rates and improve medical implant technology. Medical implants often cause inflammation inside the body, which may affect the performance of the device and can lead to severe medical complications such as implant rejection or coagulation.

In order for medical implants to function successfully in the body, the proper cell types must migrate to and populate the implanted device. Cells require highly specific extracellular surfaces for migration and proliferation and their inability to perform these tasks is often the source of medical complications. Nanotubes, which are small, synthetically produced structures similar in size to cell receptors and proteins, can be used to mimic these extracellular surfaces. Studies suggest that titanium oxide (TiO2) nanotubes enhance cell motility and proliferation [1,2]. Nanotube arrays therefore make ideal coatings for medical implants, however manufacturing processes are needed to grow nanotubes on complex 3D structures.

TECHNOLOGY DESCRIPTION

Bioengineers at UCSF have developed a novel method for coating 3D structures such as medical implants or other prosthesis with TiO2 nanotubes. Researchers are able to grow homogenous TiO2 nanotube arrays through an optimized electrochemical process. By varying the process parameters, the researchers can control the length and diameter of the nanotubes, allowing for precise coating. This is important because certain cell types might require particular extracellular topographies for migration promotion and this method ensures that such nanotopography is consistent throughout the entire device.

The researchers validated the capabilities of the nanotubes to withstand changes in the device architecture. When coated devices were compressed or expanded, the TiO2 nanotube coating remained largely intact. The researchers also found that the nanotube coating did not alter the mechanical stability of devices.

The successful fabrication of stable TiO2 nanotube coatings provides a drug-free solution to the complications of medical implants and creates a new class of bioactive coatings for use in medical devices.

APPLICATIONS

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OTHER INFORMATION

KEYWORDS

Medical implant, nanotechnology, stent, orthopedic, dental, titania, titanium oxide, nanotubes

CATEGORIZED AS

- Nanotechnology
- Tools and Devices

RELATED CASES

2013-102-0

TiO2 nanotubular coatings could be applied to a multitude of medical devices, such as:

- Implanted sensors
- Neurostimulators
- Drug implants
- Orthopedic implants or prosthesis
- Dental implants
- Stents (ureteral, esophageal, biliary, duodenal, colonic, pancreatic)

ADVANTAGES

- Drug-free
- Highly biocompatible material
- Precisely tunable dimensions for tissue-specific optimization
- May reduce device rejection and medical complications
- Decreased device failure rate

RELATED MATERIALS

- Peng L. et al, "The effect of TiO2 nanotubes on endothelial function and smooth muscle proliferation", Biomaterials, 2009, 30, pp. 1268-1272.
- Peng L, et al. "Whole genome expression analysis reveals differential effects of TiO2 nanotubes on vascular cells." Nano Lett 10: 143-148, 2010.

INVENTOR INFORMATION

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,903,035	02/27/2018	2013-102

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