Graphene Oxide-Based, Friction Reducing, Anti-bacterial and Anti-Fibrotic Coatings for Medical Implants

A novel method for producing non-toxic, anti-bacterial, anti-microbial, anti-fibrotic and osteo-integrative coatings

Objective

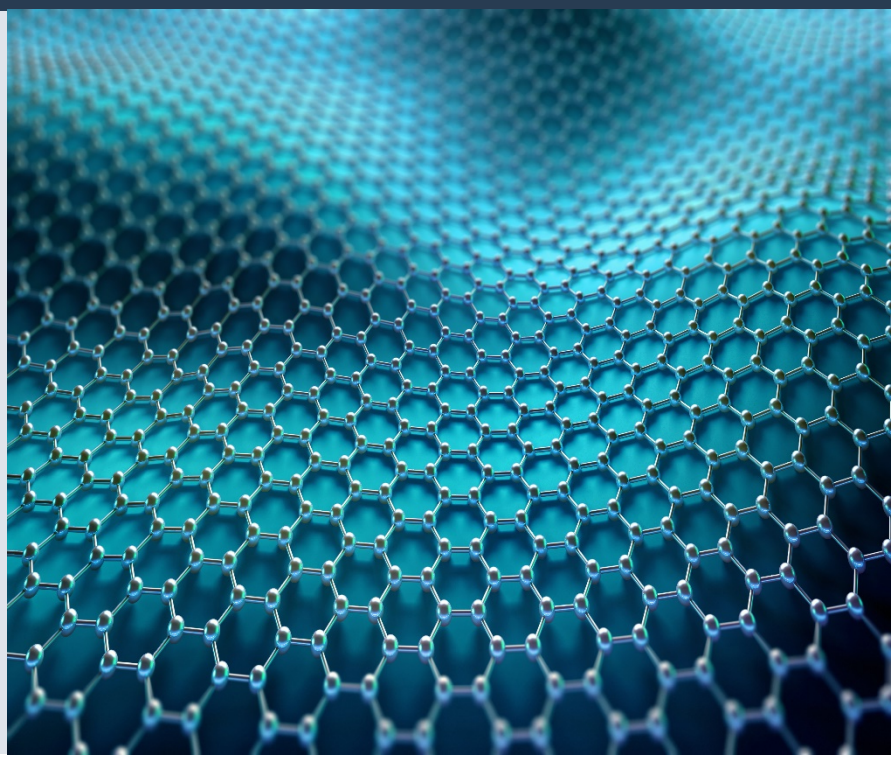
Development partner,Commercial partner

Research and IP Status

Patented

Patents

European patent applications EP19218822.5, EP19218838.1, PCT/EP2020/089606, PCT/EP2020/08658



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Background

Medical implants have revolutionized the field of orthopedic surgery by providing solutions to skeletal fractures that cannot otherwise be treated. Medical implants are largely made from titanium alloys and polymers (such as PEEK). A fundamental requirement for medical implants is to have mechanical properties (such as Young's moduli) similar to that of bone. For this reason Ti is mixed with other metals to form alloys with the correct value of Young modulus. Among these alloys, Ti-6Al-4V is currently one of the most popular for implantation. However, Al and V have been shown to be unsafe by releasing products of degradation that are potentially toxic, and therefore researchers have suggested other grades of alloys, such as Ti-30Nb-1Fe-1Hf, Ti-6Al-7Nb and Ti–15Sn–4Nb–2Ta– 0.2Pd. All of these implant materials suffer from poor integration with the human body and require extensive immune suppression drugs to avoid body rejection. That will escalate bacterial infection and the formation of biofilms which creates further medical complications. Furthermore, an excessive fibrotic tissue is generated around the implants that escalate into further complications with time.

Researchers at NUI Galway have developed graphene oxide-based coatings for medical implants that address all of the above mentioned complications regardless of the implant material of construct. The coating is non-toxic and promotes osteo-integration, is anti-bacterial, anti-microbial and assists in minimizing fibrosis. The coatings are stable and long lasting in wet conditions.

Tech Overview

The NUI Galway innovation comprises a novel method of synthesizing multi-layers of multi-functional graphene oxide-based coatings for medical implants. These coatings can be applied to medical implants, regardless of the materials of construct. The method is based on a novel deposition and cross-linking procedure resulting in a functionalizing thin film. The film is designed with precise functionalities that lead to suppression of the bacterial proliferation and growth on a time scale extended to more than 8 weeks, while encouraging the adhesion and growth of bone cells/tissue simultaneously or at a later stage (depending on the type of implants and the patient conditions). The coating is nontoxic and can be tuned to have either more bacteriostatic and/or more bactericidal properties.

Applications

- Applied in Orthopaedics and Medical devices
- Prevents bacterial adhesion (anti-bacterial/bacteriostatic)
- Reduced friction Reduced fibrosis
- Promotes osteo-integration Low cost method

Core Researcher:

Dr. Firas Awaja

For more info. contact:

John McSweeney
Case Manager,
Innovation Office, NUI Galway
John.mcsweeney@nuigalway.ie