Shih-Fu Ou, J Biotechnol Biomater 2022, Volume 12

# Improvement of antibacterial ability of NiTi alloys by depositing Ag/collagen coatings

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NiTi alloys are one of the most important shape memory alloys because of their superior shape memory effect and peseudoelasticity compared to other shape memory alloys. NiTi alloys have been used in orthopaedic device applications, such as osteotomy fixation staples and intramedullary implants owing to their unique shape memory effect, superelasticity, low elastic modulus, and good resistance to fatigue. However, they suffer some drawbacks. The NiTi alloys lack antibacterial properties, and some patients are allergic to components with Ni. This study fabricated a Ag/collagen coating on a porous oxide film on NiTi alloy to improve the antibacterial ability of NiTi implants. Plasma electrolytic oxidation was first applied on NiTi to form a porous surface, which was then coated with silver through electrochemical deposition (ECP). Collagen was then used to modulate the amounts and shapes of the Ag during ECP. It was found that Ag aggregations with coarse dendritic structures were non-uniformly distributed on the surface. The distrubution of Ag aggregations was improved by deposition of collagen and Ag in the same time. The addition of collagen enables the silver aggregation to change to a sphere-like shape. Furthermore, the assistance of collagen also reduces the size of Ag aggregation. Cross-sectional TEM indicated that many Ag clusters are aggregated with each other and fill part of the pores on the oxide surface and inside the oxide film. The deposition of Ag on the oxide film causes the contact angle to increase, which suggests that the Ag-covered surface is hydrophobic. The Ag/collagen coating improves the hydrophilicity of the porous oxide film on NiTi alloy. The Ag/collagen coating can effectively prevent adhesion adn proliferation of Escherichia coli. The oxide film can protect the substrate from bacteria adhesion but cannot kill the bacterial in the suspension

## Biography

Shih-Fu, Ou started his master study since 2003 in the department of mechanical engineering at National Taiwan University of Science and Technology for research of bone cement. Afterwards, he obtained his Ph.D. degree in 2011 from the department of mechanical engineering at National Taiwan University for research the anodic oxidation of titanium alloys applied in biomedical implants. Since 2020, he is associate professor of department of mold and die in National Kaohsiung University of Sciences and Technology. His current research is divided into three parts. The first is focused on using powder metallurgy to form bioceramic and ceramic-metal composites. The second is to develop NiTi biomaterial by arc-melting. The third is to modify the surface physical and chemical properties of Ti and NiTi alloys applied as implants.

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Miguel Ángel Pacha Olivenza, J Biotechnol Biomater 2022, Volume 12

# Efficacy of laser shock processing of biodegradable Mg and Mg-1Zn alloy on their in vitro bacterial response

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The development of biomaterials for biodegradable and bioabsorbable implants in bone repair continues to gain popularity. Magnesium and its alloys have emerged as firm candidates because they combine a suitable Young's modulus, close to that of the bone, low density, good biocompatibility and bioactivity. Despite these interesting properties, magnesium alloys also have some draw backs. For example, their relatively fast degradation rates which, depending on the nature and amount of alloying elements, can induce some toxicity. An important factor in the use for these applications is that degradation products could be at bacterial adhesion, and so contribute avoiding infection and the consequent implant failure. The antibacterial capacity of Mg–base alloys has been evaluated in previous studies but there is still a lack of consensus. Different approaches have been implemented to partly overcome disadvantages associated with the fast corrosion rate. In this work, the application of laser shock processing (LSP) technology to bioabsorbable magnesium is presented for the specificcase of a commercially pure Mg and a Mg-1Zn alloy. Zinc as an alloying element has the capability of enhancing the corrosion resistance and the mechanical properties of magnesium. Our aim is to relate the possible generated subsurface residual stresses, together with the modification of the surface microstructure, the modification of corrosion behaviour, the adhesion and viability of a strain of Staphylococcus epidermidis, which is one of the main bacteria present in nosocomial implant related infections and the specific effects of the inclusion of 1 wt% Zn in solid solution on LSP Mg.

## Biography

Pacha-Olivenza M.A., has completed his PhD at the age of 28 years from Extremadura University School of Medicine. He is a Professor at the Department of Biomedical Sciences at the University of Extremadura. His research interest is focused on the physical-chemical characteristics of surfaces that are relevant for the biocompatibility of medical devices and in the interactions between bacteria and surfaces. He belongs to the research Group of Microbial Adhesion of the Networking Research Centre on Bioengineering, Biomaterials and Nano medicine, Instituto de Salud Carlos III. He has about 35 scientific articles and more than 80 contributions to congresses.

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Martina Marsotto, J Biotechnol Biomater 2022, Volume 12

# Structural investigation of bioactive TiO2 substrates functionalized by adhesion peptides derivatized with chitosan

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In the field of tissue engineering, a promising approach to obtain a bioactive, biomimetic, and antibiotic implant is the functionalization of a "classical" biocompatible material, for example, titanium, with appropriate biomolecules. For this purpose, we propose preparing self-assembling films of multiple components, allowing the mixing of different biofunctionalities "on demand". Self-assembling peptides (SAPs) are synthetic materials characterized by the ability to self-organize in nanostructures both in aqueous solution and as thin or thick films. Moreover, layers of SAPs adhere on titanium surface as a scaffold coating to mimic the extracellular matrix. Chitosan is a versatile hydrophilic polysaccharide derived from chitin, with a broad antimicrobial spectrum to which Gram-negative and Gram-positive bacteria and fungi are highly susceptible, and is already known in the literature for the ability of its derivatives to firmly graft titanium alloys and show protective effects against some bacterial species, either alone or in combination with other antimicrobial substances such as antibiotics or antimicrobial peptides. In this context, we functionalized titanium surfaces with the peptides alone (RGD and HVP) and with chitosan grafted to the same peptides (Chit-RGD and Chit-HVP). The chemical composition, molecular structure, and arrangement of the obtained biofunctionalized surfaces were investigated by surface-sensitive techniques such as reflection–absorption infrared spectroscopy (RAIRS) and state-of-the-art synchrotron radiation-induced spectroscopies as X-ray photoemission spectroscopy (SR-XPS), and near-edge X-ray absorption fine structure (NEXAFS).

## Biography

Martina Marsotto is Ph.D student of "Material Sciences, Nanotechnology and Complex Systems" at Roma Tre University (Dept. of Science) of Rome (Italy), supervised by Assoc. Prof. Dr. Chiara Battocchio. Her research interests are biocompatible materials functionalized with appropriate biomolecules for applications in the field of tissue engineering. In particular, her Ph.D research project deals with the investigation of titania (a biocompatible material widely used in the field of implantology) surfaces modified with biomolecules, as for example oligopeptides or oligosaccharides, using Synchrotron Radiation-induced XPS, NEXAFS and FTIR spectroscopies. She has one paper, as first author.

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Raquel Galante, J Biotechnol Biomater 2022, Volume 12

# A starch-based edible coating containing anthocyanin obtained from sweet potato waste: a circular economy approach for increasing shelf time

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There is a need for sustainable solutions to increase shelf time and ensure food safety. The use of edible protective coatings in the food industry is a simple and innovative alternative, even more, when the coating is combined with active agents that confer additional functional attributes. Natural polymers such as polysaccharides are very interesting given their edibility, biodegradability, and easy access, among other aspects. Starch is one of the most widely used polysaccharides mainly due to its low cost and simple processing technologies.

In this work, sweet potato wastes were used to extract starch (SPS) and anthocyanin. The materials were combined to develop an active edible film, by gelation process.

The edible coating was characterized in terms of surface morphology (SEM), chemical composition (FTIR) and wettability. For the protective effect, different fruits (bananas, apples, passion fruit, tomato and guava) were coated with 1 or 2 layers of the coating with or without the anthocyanin incorporated.

The results showed, in general, that the coated samples showed better results regarding texture, colour, odour and delayed maturation when compared to the control. This is indicative of the potential for increased shelf-time of fruits without significant alterations to their intrinsic properties. Moreover, the extraction process, based on food waste recovery and circularity combined with the protective effect, shows the importance of this work and its alignment with several sustainable development goals.

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Asmaa Ebrahim, J Biotechnol Biomater 2022, Volume 12

# Enhancing thermoelectric properties of conductive polymers using Zr-metal-organic frameworks composite materials

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Thermoelectric generators (TEGs) that can directly convert waste heat into electricity, have many advantages over traditional electricity generators because they are considered as environment friendly, have no moving parts, have high scalability, which means they can be applied to heat source of any size. The thermoelectric performance of a material is evaluated by the dimentionless figure of merit ZT = α 2 σT/k, where α is the Seebeck coefficient, T is the absolute temperature, σ is the electrical conductivity, and k is the thermal conductivity. So decreasing the thermal conductivity (k) of the material is a critical issue to improve its performance. TEGs are possible devices using for power generation for implantable devices such as Glucose monitor, Drug pump, Cochlear implant and many other devices. The power requirements for most of the implantable devices ranging from 30μW–2mW, which can be provided by TEGs from the human's body heat.

Polypyrrole, a conducting polymer, attracts most of the attention due to its ease of preparation, high thermal and environmental stability and biocompatibility, which make it a good candidate for implantable TEGs. Most of metal-organic frameworks (MOFs) are considered as insulator with low thermal conductivity and high stability and biocompatibility. MOFs are intrinsically porous that in turn can scatter phonons through the material.

Conclusion and significance, Controlling the polymerization of polypyrrole (Ppy) in presence of Zr-based metal organic-framework (Zr-MOFs) using sodium dodecyl sulphonate (SDS) as a dopant, leads to the formation of a new class of thermoelectric materials based on conducting polymer and highly porous MOFs with enhanced properties for energy production applications. The polymerization of polypyrrole in the Zr-Fumerate pores leads to the formation of homogenously coated MOF-spheres with high crystallinity and a high degree of improvement in many electrical properties such as conductivity and carrier mobility. ows the importance of this work and its alignment with several sustainable development goals.

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