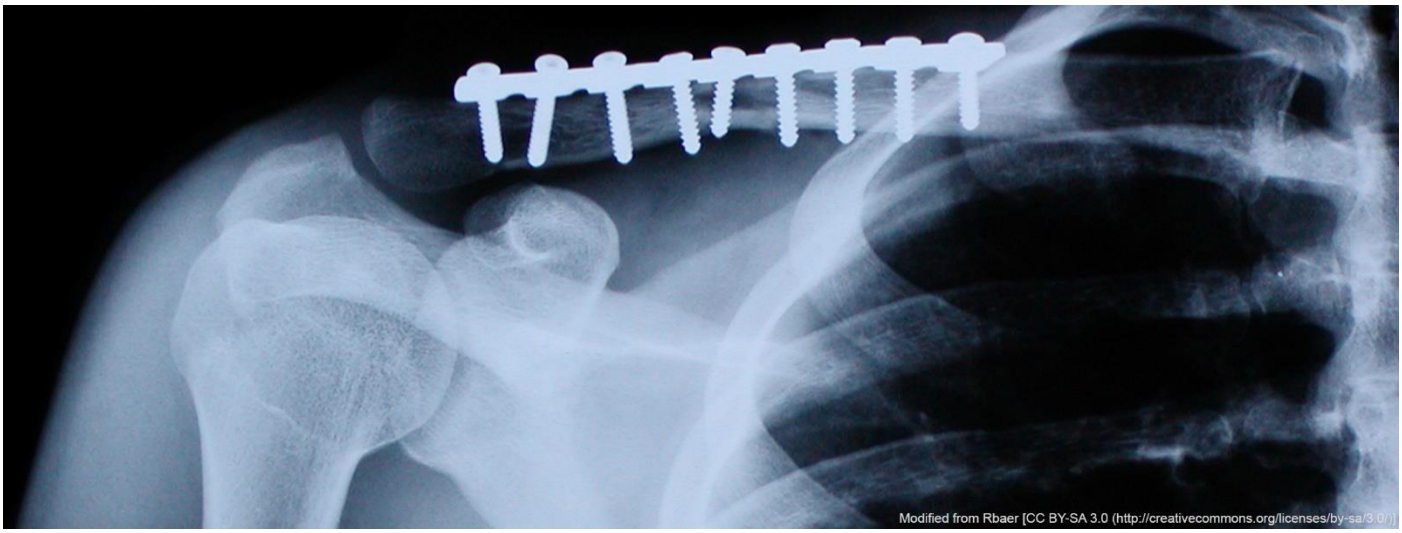
BioMEMs – BIOMICROELECTROMECHANICAL SYSTEM DEVICE FOR BONE REGENERATION



TECHNOLOGY SUMMARY

BioMicroElectroMechanical System devices (BioMEMs) targeted to the promotion of bone regeneration by means of coating a biomedical metallic substrate with a functionalized ferroelectric/piezoelectric biocompatible oxide layer or with a functionalized piezoelectric biocompatible and biodegradable polymeric layer.

APPLICATIONS

This technology aims to be used for:

COATING OF ORTHOPAEDIC BIOMEDICAL METALLIC DEVICES

Targeted to:

PROMOTION OF BONE REGENERATION

REDUCTION OF BONE IMPLANT FAILURE

BIOLOGICAL *IN VIVO* OR *EX VIVO* TISSUE GROWTH

BENEFITS

AIMED FOR BONE REGENERATION:

- HIGHER SURFACE WETTABILITY AND ENERGY
- HIGHER RATE OF CALCIUM PHOSPHATE FORMATION
- HIGHER PROTEIN ADSORPTION

NO INFLAMMATORY REACTIONS for *in vivo* implanted functionalized ferroelectric/piezoelectric coated 316L-type stainless steel

CONTEXT

Biomedical metals, in particular due to their excellent mechanical properties, are commonly used in clinical treatments as supporting or fixation elements. In order to overcome its poor bioactivity and consequent unsuccessful osseointegration, research and developments have been done to these biomedical metals to endow them with different bio-functions. One of the most effective ways to bio-functionalize the traditional base material is still *via* surface modification.

Several types of surface modification of metallic implants are reported in the literature as promising strategies to improve tissue tolerance, osseointegration and implant corrosion resistance; however, there is still the need to overcome key limitations as bacterial proliferation and coating peeling.

It is known that electrical stimulation can modulate cell functions as growth, migration and mitosis rate, as well as boosting growth, maintenance or regeneration of bones, tendons and ligaments. In addition, the piezoelectric nature of collagen and movement of ionic fluids within the structure generates electrical potentials in bones under mechanical loading.

Within these premises the present technology consists of an alternative strategy, coating a biomedical metallic substrate with a functionalized ferroelectric/piezoelectric biocompatible oxide layer or with a functionalized piezoelectric biocompatible and biodegradable polymeric layer; i.e. the combination of a functional ferroelectric/piezoelectric layer with a metallic implant in which the piezoelectric works as a potential approach for successful osseointegration.

BioMEMs – BIOMICROELECTROMECHANICAL SYSTEM DEVICE FOR BONE REGENERATION

IP RIGHTS

International patent pending (PCT – Patent Cooperation Treaty), with the application number WO2019008552 (A1).

DEVELOPMENT STAGE

TRL 4: The materials were already tested at laboratorial scale, with *ex vivo* and *in vivo* experiments.

Preliminary *in vivo* experiments with implanted functionalized ferroelectric/piezoelectric coated 316L-type stainless steel demonstrated absence of inflammatory reactions.

KEYWORDS

BIOMICROELECTROMECHANICAL SYSTEMS

COATED BIOCOMPATIBLE METALLIC SUBSTRATES

FUNCTIONALIZED FERROELECTRICS

FUNCTIONALIZED PIEZOELECTRICS

316L-TYPE STAINLESS STEEL

COATED 316L-TYPE STAINLESS STEEL

LITHIUM TANTALATE

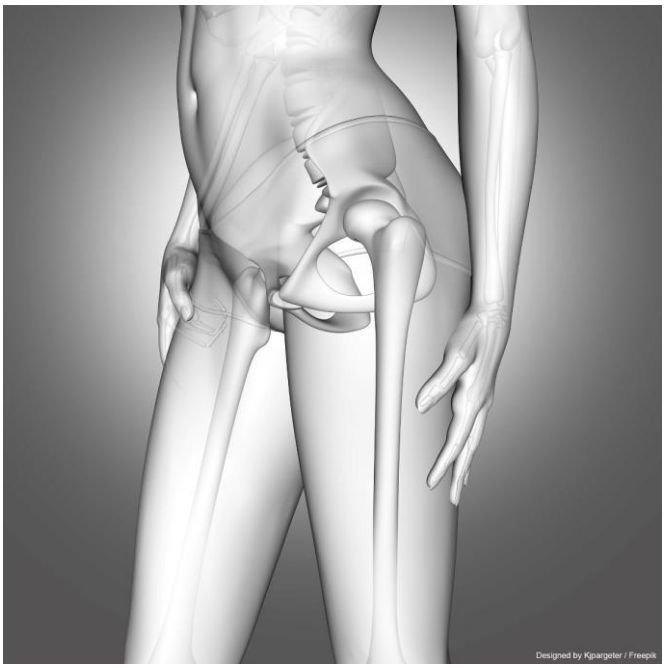
POLY L-LACTIC ACID

CONTACT

Universidade de Aveiro
UATEC – Unidade de Transferência de Tecnologia
Edifício do Departamento de Educação e Psicologia
Campus Universitário de Santiago
3810-193 Aveiro | Portugal

tel: +351 234 370 887
e-mail: uatec@ua.pt
web: www.ua.pt/uatec

Technology #CI17014



DEVELOPED BY

Researchers of Aveiro Institute of Materials (CICECO) from the University of Aveiro.

BUSINESS OPPORTUNITY

Technology transfer by licensing agreement.

Technology joint further development.

Adaptation to specific needs.

Co-development of new formulations and/or applications.

PARTNERSHIP

The University of Aveiro seeks industrial partners within bone prosthetics industry interested in licensing the technology and/or jointly further develop the technology and/or collaborate to develop new technologies within this area.

TRL: Technology Readiness Level – more information in https://ec.europa.eu/research/participants/portal/desktop/en/support/faqs/faq-2890.html