VITROCERAMIC COATINGS BONDED TO METALLIC IMPLANTS FOR DENTAL AND ORTHOPAEDIC APPLICATIONS

Cristina Busuioc, Izabela Constantinoiu, Dana Miu, Sorin-Ion Jinga

CertBond
COST Action CA18120

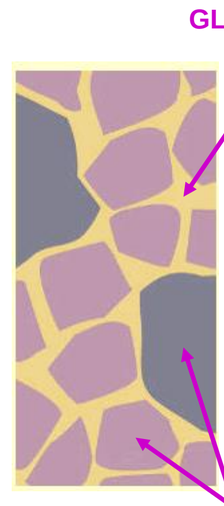
In the framework of "bonded structures" concept, we propose the development of mineral thin films through physical or chemical approaches, with the aim of improving the biological response of metallic implantable devices by controlling the biochemical processes occurred at the interface between the living tissue and artificial bone substitute. It is obvious that the targeted application is dedicated to the tissue engineering and regenerative medicine fields, namely repair of bone defects, regeneration of diseased tissues or replacement of lost parts from the skeletal system.

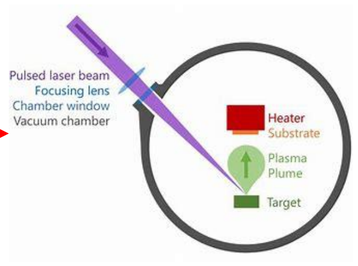
Looking for potential solutions as response to the large variety of clinical issues, we have explored the vitroceramic area of inorganic materials, which provides, through its glassy and crystalline phases, suitable features for the imposed standards within the domain of hard tissue engineering. Thus, the vitreous matrix ensues a rapid and tunable interaction with the body fluids, while the different families of crystalline domains enhances the mechanical characteristics and biocompatibility factors.

$SiO_2–P_2O_5–CaO–CaF_2$
$SiO_2–P_2O_5–CaO–MgO–ZnO–CaF_2$

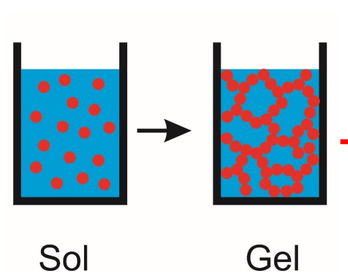
$SiO_2–P_2O_5–CaO–MgO–ZnO$
$SiO_2–P_2O_5–CaO–SrO–ZnO$

$SiO_2–P_2O_5–CaO–MgO–Na_2O$
$SiO_2–P_2O_5–CaO–MgO–SrO–Na_2O$
$SiO_2–P_2O_5–CaO–MgO–CeO_2–Na_2O$

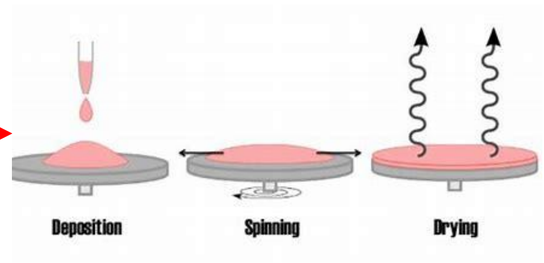




PULSED LASER DEPOSITION

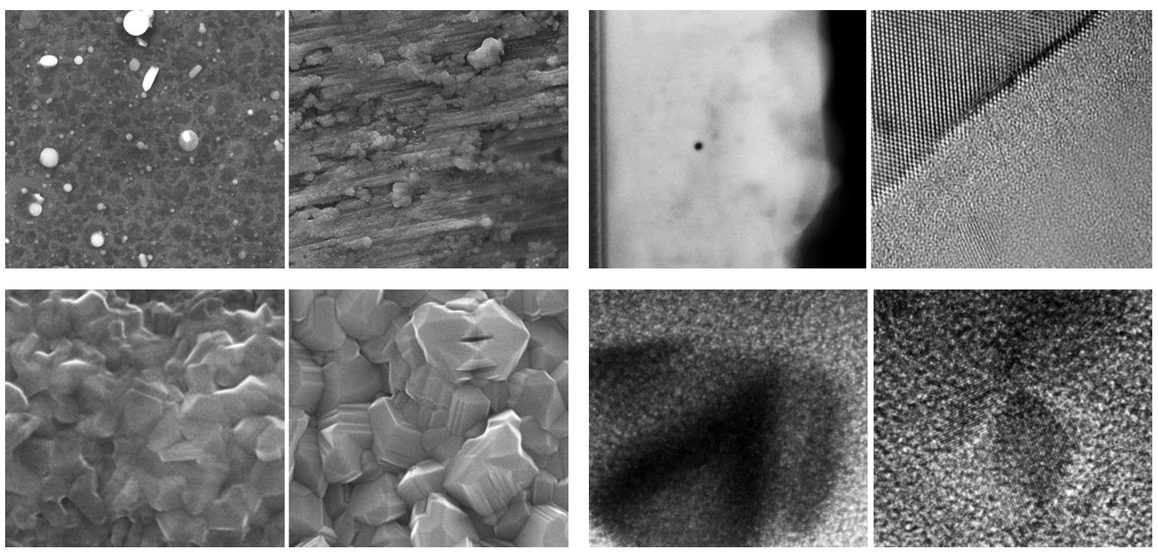


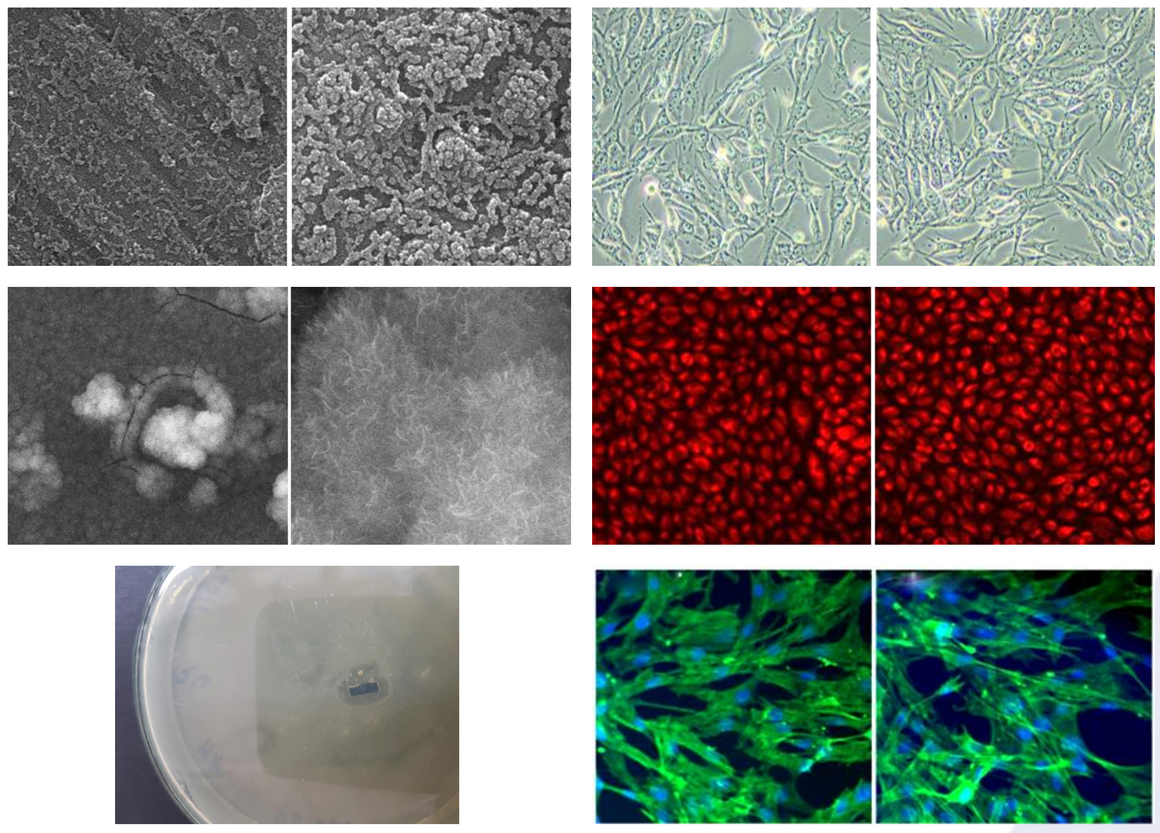
SOL-GEL



SPIN COATING

In this context, we present several oxide systems that were studied from the material design to the functionality assessment, the synthesis being carried out through laser ablation on a wet-chemistry prepared target or spin coating combined with a sol-gel approach. The resulting layer-on-substrate bonded structures were characterized from compositional, structural and morphological point of view by X-ray diffraction, Fourier-transform infrared spectroscopy, scanning and transmission electron microscopy, energy-dispersive X-ray spectroscopy and selected area electron diffraction. Moreover, the *in vitro* investigations revealed the bioactivity, biocompatibility and sometimes antibacterial characteristics of the obtained coated metallic implants.





Concluding, the results indicated the growth of nanostructured vitroceramic thin films of few hundreds of nanometers thickness, with an excellent bioactive behaviour after 28 days of testing, as well as good biological effect on the selected cell cultures, which confirms the suitability of such bonded structures for medical applications.

Funded by the Horizon 2020 Framework Programme of the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Corresponding author: Cristina BUSUIOC
E-mail: cristina.busuioc@upb.ro
jinga_cristina@yahoo.co.uk