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Bio-inspired process to yield intelligent scaffolds for tissue engineering and nanomedicine

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The present work illustrates how bio-mineralization, an amazing natural process with which nature has realized and optimized a profuse collection of living organisms endowed with astonishing abilities can be used to guide efforts for developing biomaterials for bone and osteochondral regeneration. In particular it will be illustrated how the self-assembling and bio-mineralization of natural polymeric fibers can be induced by reproducing the conditions of formation of new bone tissue in mammals, thus obtaining a collagen-based matrix where mineralization with nanoparticles of biomimetic apatite can take place. The reproduction of biomimetic conditions of bone synthesis allows obtaining hybrid constructs where the mineral phase is nucleated upon guidance by the chemical features and physical confinement imposed by the polymeric matrix, so that the mineral phase has physical, chemical and ultra-structural resemblance with mineral bone, thus providing very high osteogenic activity when implanted *in vivo*. Besides, the possibility to vary the degree of mineralization allows to obtain multi-layer graded devices able to regenerate the different districts of the articular region (subchondral bone, mineralized and hyaline cartilage). Finally, pinning on the recent development of intrinsic super paramagnetism exhibited by hydroxyapatite nano-powders upon crystallographic and chemically controlled doping with Fe(II)/Fe(III) ions, it will be illustrated how bio-hybrid bone-like devices with intrinsic magnetic properties can be obtained; such devices can increasingly assist the osteogenic and angiogenic capacity of biologically inspired bone and osteochondral scaffolds, through magnetically-driven release of specific growth factors.

Biography

Anna Tampieri is senior Researcher at ISTEC-CNR coordinating the research group on Bioceramics and Bio-hybrid Composites. She is the author of more than 180 papers published on international Journals and inventor of 15 international patents. She is the Founder of Biotech Company "FINCERAMICA". She is the Coordinator of several European projects and national projects belonging to Nanotechnologies and Nanomaterials theme. She is also the member of the Nanomedicine European platform and senior affiliated member of Methodist Hospital Research Institute - Houston (Texas - USA).

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Fabrication and testing of 3- way catalytic converter with nano metal oxides on stainless steel substrate

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There are several ways for controlling automobile pollution, but most effective way is by using a catalytic converter in the automobile. The objective of this work aims to fabricate a low cost and highly efficient three way catalytic converter. The catalytic converter was developed based on catalyst materials consisting of nano metal oxides such as titanium dioxide (TiO₂) and cobalt oxide (CoO) with wire mesh substrate. Both of the catalyst materials (such as nano TiO₂ and CoO) are inexpensive in comparison with conventional catalysts (noble metals) such as palladium or platinum. The coating methodology adopted is sol gel and nano electrochemical deposition methods. The nano structure of the particles is validated using SEM-EDAX and XRD. In addition, the noble metals such as platinum group metals are now identified as human health risk due to their rapid emissions in the environment. The Catalytic converter with nano metal oxide catalyst and stainless steel substrate is fabricated and tested for emission of pollutants. The original converter is tests for the exhaust emissions and it is used for the comparison purpose. The results show that the catalytic converter made from metal oxides and the stainless steel substrate can control the pollutants within the emission limit. Also the cost of the converter can be greatly reduced.

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