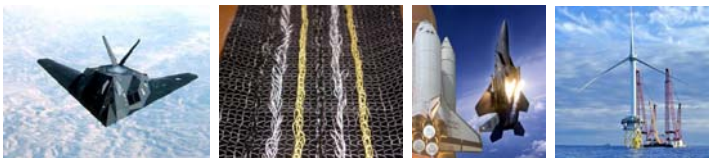
ICCM17 Edinburgh
27-31 July 2009, Edinburgh, UK



Biomedical Applications

Oligomer Coupling Agents in Phosphate Based Glass Fibre/PLA Composites
P Haque, AJ Parsons, I Ahmed, DJ Irvine, GS Walker, CD Rudd (Univ of Nottingham)
Polylactic acid oligomers as coupling agents have showed potentially higher interfacial shear strength in phosphate based glass fibre/ PLA composites. To influence bonding on the glass fibre surface, the short chain PLA with different end groups were used as coupling agents. Mechanical properties of the sized fibres/PLA composites were determined. **(B1:1)**

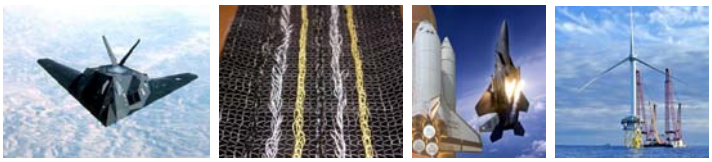
Change In Deformation/Fracture Behavior of Interface-Controlled HAp/PLLA Composites by Hydrolysis
M Tanaka (Kanazawa Inst of Tech) H Tanaka, M Hojo, T Adachi (Kyoto Univ) M Sugihara, M Kotera, T Nishino (Kobe Univ)
In this study, the interface-control for HAp/PLLA composite was tried in order to improve the interfacial bonding strength. The effects of interface control and hydrolysis on mechanical and fracture properties of HAp/PLLA composites were evaluated by three point bending tests. The effect of interface control on hydrolysis behavior was discussed from the viewpoint of interfacial mesoscopic structures. **(B1:2)**

Effect of Plasma Treatment on the Bioactivity of Poly(L-Lactide) - Hydroxyapatite Nano-Composites
H Deplaine, JL Gómez Ribelles, G Gallego Ferrer (Univ Politécnica de Valencia)
Poly(L-lactide)/hydroxyapatite nano-composite membranes for bone regeneration with different concentrations of nanoparticles have been prepared and their physicochemical properties and bioactivity have been determined. The treated plasma composites present a faster kinetics of formation of an apatite layer on the surface when immersed into a SBF solution. **(B1:3)**

Nanocomposite Scaffolds Based on Bacterial Cellulose and Polylactide Towards the 3D Culture of Haemopoetic Stem Cells
JJ Blaker, KY Lee, A Mantalaris, A Bismarck (Imperial College London)
Novel composite scaffolds have been fabricated using bacterial cellulose and polylactic acid (PLA) using a combined ice microsphere templating and thermally induced phase separation route. The technique was developed to achieve both controlled interconnected pore structures and most importantly to result in pores lined with nano-bacterial cellulose whiskers. **(B1:4)**

Delivery of Therapeutic Cells in Hydrogel Composite Free of Adoptotic Depletion
CM Wang, DA Wang (Nanyang Tech Univ)
This study is about how to deliver anchorage-dependent therapeutic cells in spread morphology with injectable hydrogel composites, by which the cellular focal adhesion can remain intact and cell viability and functionality can be ensured. **(B1:5)**

Fabrication of 45S5 Bioactive Glass-Polycaprolactone Composite Scaffolds
V Cannillo (Univ of Modena & Reggio Emilia)
45S5 bioactive glass-polycaprolactone composite porous scaffolds were produced using a solution blending and salt-leaching technique. The main target was the optimisation of the fabrication parameters (such as: blending conditions; nature and amount of salt; glass weight fraction and granulometric size distribution) in order to confer a suitable porosity and composition to the composite scaffold. **(B1:5A)**



Membranes Of Pdlla/Bioglass® With Asymmetric Bioactivity For Biomedical Applications
JF Mano, SG Caridade, EG Marino (3B's Research Group)
The aim of this study was the production of biocompatible and biodegradable membranes with an asymmetric bioactivity. The composite membranes exhibit gradient concentration of the inorganic particles along the material thickness. These properties make this kind of systems ideal for orthopaedic applications, including guided tissue regeneration. **(B1:6)**

Preparation of Poly(Lactic Acid)-Vaterite Hybrid Membranes for Guided Bone Regeneration
T Kasuga, A Obata (Nagoya Institute of Tech) T Wakita (Yamahachi Dental MFG) Y Ota (Yabashi Industries Co)
A novel membrane for guided bone regeneration was developed using poly(L-lactide acid) (PLA)/siloxane-containing vaterite hybrid material (Si-PVH) by an electrospinning method. The Si-PVH fibers were covered with hydroxyapatite by soaking in simulated body fluid. The Si-PVH cloth was bonded with a PLA cloth for the barrier of soft tissue intrusion. **(B1:7)**

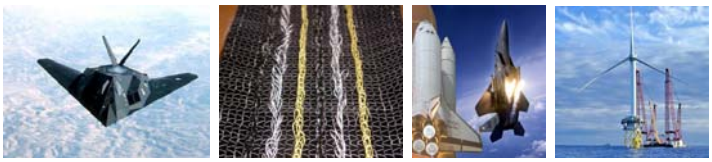
Toughening Denture Base Resin with Short PVOH Fibers
J Jancar (Brno Univ of Technology)
Effect of fiber type, aspect ratio and orientation on the static and dynamic critical strain energy release rate is analyzed using a currently model proposed. **(B1:8)**

Mechanical and Corrosion Behaviour of a Hydroxyapatite Reinforced Magnesium Alloy We43
H Dieringa, C Blawert (GKSS Research Centre)
Magnesium based hydroxyapatite containing composites are a potential biodegradable implant material. Screws made of this material have the ability to release hydroxyapatite during corrosion process which is part of the natural bone composition. Structure, mechanical properties as well as corrosion behaviour of this composite are investigated in this paper. **(B1:9)**

Design of Novel Multi-Phase Composite Scaffolds for Bone Regeneration
A Salerno, M Oliviero, E Di Maio (Univ of Naples Federico II) S Zeppetelli, S Iannace (IMCB-CNR) P Netti (CRIB)
The design of bioactive scaffolds able to guide cellular processes involved in tissue-genesis is key determinant for bone tissue engineering. The aim of this study was the design of novel biomaterials able to: i) promote the osteogenic differentiation of rabbit mesenchymal stem cells and ii) be further processed into well controlled 3D porous scaffolds. **(B1:10)**

Amphiphilic Chitosan/Poly(L-Lactide) Composite Films: Miscibility and Application for Tissue Engineering Scaffold
M Li (Huaqiao Univ)
Amphiphilic N,N-dilauryl chitosan/PLLA (NCS/PLLA) composite films with three different weight ratios were prepared by solution approach using CHCl3 as co-solvent. The miscibility of NCS/LLA composite systems is studied by FTIR, DSC, XRD and SEM techniques. **(B1:11)**

Chondrocyte Morphology on Polymer-Silica Nanocomposites Prepared by Sol-Gel Technique
MS Sanchez (Technical Univ of Valencia)
Polymer-silica nanocompostites based on poly(2-hydroxyethyl acrylate), PHEA, were prepared with different amounts of silica ranging from 5 to 30 wt.%. Chondrocyte adhesion and morphology was investigated as a function of the amount of silica in the system. Peculiar cell behaviour was shown to occur as the fraction of silica in the system increases. **(B1:12)**



Microarchitecture of Reinforced HA/TCP Bone Substitutes for Human Implantations
SS Henriksen, M Ding, S Overgaard (Odense Univ Hosp) N Theilgaard, MV Juhl, S Clyens (Danish Tech Inst)
This study analyzes the 3D-microarchitectural properties of selected composite scaffolds reinforced with a biocompatible polymer for bone implantation, and compares them to those of a calcium-phosphate scaffold without polymer. The biocompatible polymer should be added to the scaffold without compromising the 3D-microarchitectural properties. **(B1:13)**

PCL-Hydroxyapatite Composite Scaffolds for Bone Regeneration
M Lebourg, JL Gómez Ribelles, JJ Suay Antón (Polytechnic Univ of Valencia)
Scaffolds are used in tissue engineering as a physical support for tissue regeneration. Polymer-ceramic composites may be useful for bone regeneration. Here we used poly(e- caprolactone), together with hydroxyapatite, in order to obtain scaffolds with enhanced mechanical properties and bioactivity, and enhanced bioactivity by surface modifications. **(B1:14)**

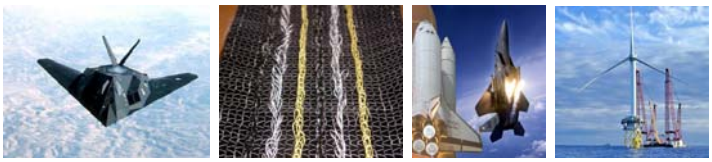
Hierarchally Microstructured Fibrous Composite Scaffolds as Bone ECM Analogue
V Guarino, L Ambrosio (National Research Council)
Three-dimensional porous composite scaffolds based on poly(e-caprolactone) (PCL), were fabricated through the combination of filament winding technique and phase inversion/salt leaching process. The balance between chemical composition and spatial organization of reinforcement systems allows attaining an optimal compromise between mechanical response and bioactive potential to reproduce the bone mECM features. **(B1:15)**

Ferrimagnetic Glass-Ceramics For Cancer Therapy
O Bretcanu, S Ferraris, M Miola, E Vernè (Politecnico di Torino)
The aim of this work is characterization of bioactive ferrimagnetic glass-ceramics for magnetic induction hyperthermia. These biomaterials contain different amounts of magnetite crystals, are bioactive and biocompatible to the human osteosarcoma cells. The surface of these materials was modified in order to bind two different antitumoral drugs. **(B1:27)**

Bioactive Glass-Ceramic Nano-Particles for the Development of New Smart and Biomimetic Biomaterials
JF Mano (Univ of Minho)
In this presentation we resume the work that has been performed in our research group on the use of new glass-ceramic nano-particles, prepared by a simple sol-gel methodology, in the development of new osteoconductive composites for biomedical applications. **(B1:28)**

Chitosan InGap-Quantum Dots Conjugate Nanoparticles for Live Cell Imaging of Glia
M Tabrizian, MG Sandros, RA McKinney, M Behrendt, D Maysinger (McGill Univ)
A wide variety of fluorescent nanoparticles have been recently investigated as bioimaging tools in medicine. This study focuses on new, highly fluorescent chitosan-modified InGaP/ZnS quantum dots (QDs) for examining their intracellular fate in living glial cells. Confocal microscopic studies revealed the distribution of aggregated and non-aggregated chitosan-InGaP/ZnS nanoparticles in live cells together with several cellular organelles. **(B1:29)**

Functionalized Magnetic Nanoparticles for Selective Targeting of Cells
W Tremel, MI Shukoor, F Natalio, MN Tahir, K Schneider, T Schladt, M Wiens, HC Schröder, WEG Müller (Johannes Gutenberg Univ)
Pathogen-mimicking metal oxide nanoparticles with the ability to enter cancer cells and to target and activate TLR9 pathway selectively have been designed in addition to optical and MR imaging capabilities. The multifunctional polymer used for the surface modification affords a protective biocompatible shell and provides an efficient means for loading immunostimulatory oligonucleotides. **(B1:30)**



Poly(Lactic Acid) Composite Scaffolds Comprising Bacterial Cellulose Nano-Fibres
XW Yuan, AJ Easteal, D Liu, D Bhattacharyya (Univ of Auckland) J Li (Tianjin Univ)
Nano-composites using natural biodegradable materials are new and have significant potential in manufacture of scaffolds for biomedical applications. This study focuses on developing composite materials comprising bacterial-cellulose nano-fibres in a poly(lactic acid) matrix, with improved biodegradability, biocompatibility, and better porous structure and cell-surface adhesion. **(B1:31)**

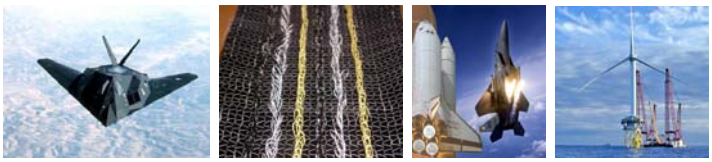
Properties of Biodegradable Composite Materials as Bone Regenerative Implants
P Haque, I Ahmed, AJ Parsons, IA Jones, GS Walker, CD Rudd (Univ of Nottingham)
Biodegradable composites comprising either PCL/PLA matrices were reinforced with phosphate-based glass fibres and characterised. Fibres were either heat-treated or non-treated. Degradation studies revealed a plateau after 350h. For PCL a five fold increase in modulus was seen, whilst for PLA the strength profiles obtained were equivalent to cortical bone. **(IB1:1)**

Mechanical Behavior of Hydrolyzed Tricalcium Phosphate/ Poly(L-Lactide) Composites under Various Loading Rates
S Kobayashi, S Yamadi (Tokyo Metropolitan Univ)
Effects of strain rate on the mechanical properties of bioabsorbable traicalcium phosphate / Poly(L-lactide) composites after immersion into simulated body environments were investigated. Tensile strength decreased after 8 weeks immersion, and then kept constant. And tensile strength increased with increasing strain rate. Strain rate dependency became larger with immersion period. **(IB1:2)**

Polymeric Composites, Prepared by Sol-Gel Method, with Spatial Gradients of HA Bioactive Signals
MG Raucci, V Guarino, L Ambrosio (IMCB-CNR)
This work is aimed to define novel strategies to develop of bioresorbable composite materials for bone repair and regeneration. This study describes the preparation and characterization of HA/PCL composite substrates by sol-gel method and biomineralization. In particular, the proposed synthesis allows improving the interaction between the ceramic and the polymer phases whereas the surface biomineralization through a bone-like apatite layer enable to enhance the bone cell recognition from cells. **(IB1:3)**

Composites of Polypropylene and Hydroxyapatite: Effects of Copolymers of Propylene and Acrylic Acid on the Mechanical Properties
R Perera (Simon Bolivar Univ) C Albano, R Casella (Univ Central de Venezuela) L Cataño, A Karam, G González (IVIC)
The increased need for new materials resembling human bones has led the search for new composites of polymers and bioactive fillers. In this investigation, composites of polypropylene and hydroxyapatite were prepared. The influence of adding copolymers of propylene and acrylic acid on the mechanical properties of the composites is presented. **(IB1:4)**

Experimental and Numerical Simulation of Mechanical Actuators Coated with PMMA and Bonelike Micro Particles for Bone Cells
C Frias, A Marques (Univ do Porto) J Reis, F Silva, J Potes (Univ de Évora) J Simões (Univ de Aveiro)
A finite element modelling has been used to characterize the mechanical stress, cell shear stress and strain caused by a mechanical bioactuator based on piezoelectric technology. **(IB1:5)**



Fabrication and Characterization of Drug-Loaded Sutures from Composite Nanofibers
H Wen, H Zhengming (Tongji Univ)
Drug-loaded poly(L-lactic acid)(PLLA) sutures are fabricated by combining a co-axial electrospinning technique, alignment collection, post-treatment for fiber threads, and a braiding method. Bioabsorbable PLLA material is used as the shell whereas cefotaxime sodium is incorporated into the core of shell/core composite nanofibers obtained through coaxial electrospinning, which are collected in alignment using a sharp-edged rotating disk. **(IB1:6)**

Synthesis of Drug Loaded Iron Oxide Nanoparticles
N Bolden, V Rangari, S Jeelani (Tuskegee Univ)
Sonochemically synthesized iron oxide and PVA-coated iron oxide nanoparticles were loaded with cancer therapy drugs and tested for their drug loading capacity and retention of magnetic properties. Polymer coatings such as polyvinyl alcohol have been developed to provide both biocompatibility and an environment for drug loading. The transmission electron microscopic and magnetic characterizations show that the magnetic particles are ~10nm in size and superparamagnetic in nature. **(IB1:7)**

The New Generation of Composite Membranes for Ophthalmology Application
E Stodolak, T Gumula, S Blazewicz (AGH UST) J Wieczorek (National Res Inst of Animal Product)
R Leszczynski (Medical Univ of Silesia)
The new generation of biomaterials designed for intracorneal ophthalmological implants was invented and produced in the Department of Biomaterials, Faculty of Materials Science and Ceramics, University of Science and Technology (Krakow, Poland). This biocompatible biomaterial exhibits specific biomechanical parameters, which enables its use as an ophthalmological implant. **(IB1:8)**

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