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# Biodegradable Polymeric Matrix Composites for Tissue Regeneration Applications

*G.Chouzouri (a), D. Abdeljabbar (a) and M.Xanthos (a, b)*
*(a) Otto H. York Department of Chemical Engineering, New Jersey Institute of Technology, Newark, NJ 07102*
*(b) Polymer Processing Institute, New Jersey Institute of Technology, Newark, NJ 07102*

Over the last decades, biomaterials for use in bone regeneration applications are in the center of interest for researchers throughout the world. Since not a single biomaterial is appropriate for all tissue engineering applications, there is an absolute necessity for a better understanding and further development of engineered, new biocomposite materials. For these materials, distinctive mechanical performance, biocompatibility and bioactivity have to be tailored depending on the specific bone growth application. In this study, biodegradable matrix composites for use in temporary bone growth applications have been investigated. These composites were produced by extrusion melt or solution mixing. Polymeric matrices such as poly-L-lactic acid and polycaprolactone have been used to incorporate a variety of several established and novel fillers such as calcium phosphates, silicates, glasses and double-layer hydroxides. The bioactivity of these fillers was first evaluated *in vitro,* in the absence of a polymer matrix using a simulated body fluid (SBF), which contains almost the same ion concentration as the human blood plasma. Each filler appeared to have a different surface apatite forming ability, needed for bone ingrowth. Following incorporation of these fillers in the biodegradable matrix, the effect of mixing and shaping method, and polymer type and MW on the bioactivity of the composites has also been examined. At different time periods the exposed to SBF samples were characterized by SEM, EDX and FTIR microscopy in order to investigate the rate and the uniformity of the nucleation of the apatite crystals. The rate of degradation of the polymeric matrices was also investigated by exposing the biocomposites in phosphate buffer saline solution (PBS), and observing weight and mechanical property changes over time. Depending on polymer and filler type and process conditions, a series of versatile composites was produced for further *in vivo* evaluation in a variety of tissue engineering applications.