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New concept of bioresorbable polymer-based ceramic hybrids for cardiovascular stent applications

This presentation will introduce new theories and industry practice for design and development of polymer-based ceramic hybrids. The evolution from pure polymer-based medical devices to polymer-based ceramic hybrids is to meet unmet market needs for better clinical performance over existing systems. There are many factors that can affect medical implant performance and, historically, most of them have been well studied, such as bioactivities and biocompatibility. In this presentation, new concept will be mainly addressing issue surround biomechanics, bio-fracture mechanics and bio-functionality for design and development of new hybrid biomaterials for implant applications. It will report the principles on formulations for two types of the new systems. One family is of biodegradable and bioresorbable hybrids and 2nd is of non-biodegradable hybrids. It will be followed by design and development of medical devices in view of industry practice with clinical performance considerations of medical devices. The main topics covered in the presentation include: New concepts and synthetic pathway of polymer-based ceramic hybrids; nano/micro mechanics and nano/micro fracture mechanics; industry practice – two case studies will be used to demonstrate on how to design and develop polymer-based ceramic hybrid biomaterials and relevant processing technology for the applications of medical implants. Cardiovascular stent, as an example is traditionally made of metal such as bare metal stents (BMS) or with drug coatings, i.e. drug eluting stents (DES). There are, however, clinical complications associated with these technologies, such as, early stage restenosis, very late thrombosis and risk associated with revision surgery. In light of these challenges research focus has turned to the development of bioresorbable vascular scaffold (BVS) technologies. We have developed new bioresorbable polymer-based ceramic stent that has been reinforced resorbable therapeutic cardiovascular stent to address the known limitations of cardiovascular technologies. We have developed a bioresorbable stent with intrinsic toughness for handling and deployment via balloon angioplasty, radial strength, controlled drug-release technology to suppress restenosis and surface functionalization to promote endothelialization to reduce risk of thrombosis. We present the novel synthetic polymer-ceramic composites developed as candidate stent-core materials, both their preparation and the characterization of their mechanical behavior, *in vitro* degradation will be presented.

Biography

Xiang Zhang is a Royal Society Industry Fellow at University of Cambridge. He has over 34 years combined academia (17 years) and industrial (17 years) experience in Advanced Materials Science and Technology. He is an expert in Polymer and Polymeric Hybrid Materials Science and Technology. He is Head of Lucideon Cambridge School of Advanced Materials. He is an author of three books: "*Inorganic Biomaterials; Inorganic Controlled Release Technology* and *Science"* and*; "Principles of Biodegradable"* and *"Bioresorbable Medical Polymers - Materials and Properties*". He completed his PhD and Post-doctoral research at Cranfield University where he studied "Materials physics, nano/micro-mechanics and nano/micro-fracture mechanics of polymeric hybrid (organic and inorganic) materials".

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