Processing of Bioresorbable Polymers for Drug-eluting Medical Devices

Description of Project:
Bioresorbable polymers are being increasingly used in devices such as cardiovascular stents, tissue scaffolds and fixation devices for bone repair which degrade inside the body as new tissue forms. Ideally, the polymer device degrades at a controlled rate, matching that of tissue regrowth. Developments have been made whereby drugs or other bioactive particles are impregnated in the polymer such that as the device degrades, controlled release of the doping substance is achieved – this may be to achieve an anti-inflammatory response, site-specific drug delivery; or to release ceramic particles which themselves promote tissue healing. However, development times for new devices can be lengthy and extremely expensive. To reduce development time and cost and to ensure reliable and predictable performance of these products it is vital that the influence of typical processing procedures on the degradation and mixing and hence subsequent bioresorption/release behaviour and mechanical properties are fully investigated.

The aim of this study is to improve the monitoring and control of processing of bioresorbable polymers and polymer/ceramic composites and will involve the following stages:

- Establish process factors which influence bioresorbable device performance
- Develop in-line/off-line characterisation techniques to monitor the properties of bioresorbable polymers/composites during melt-processing
- Evaluate the degradation and release rate of polymers following a range of processing procedures
- Develop modelling techniques capable of recommending the optimum processing conditions to provide a device with the required biodegradation behaviour and mechanical properties

The potential to accelerate development time for bioresorbable medical devices would impact significantly on the number of surgeries (biodegradable parts do not need a second surgical operation to remove the device once the original tissue has healed) and on the prognosis for recovery due to enhanced biocompatibility and the ability of the device to promote healing.

Profile of Student:

The ideal candidate will have a 1st class/2:1 Honours degree in Mechanical or Process Engineering or similar with an interest in polymer processing, medical devices and process monitoring and optimisation. Alternatively, a candidate with a strong Mechatronics or Instrumentation and Control background with an interest in polymer processing/medical devices would also be suitable. Knowledge and experience of the polymer processing and/or medical device industries would be an advantage.