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POLYMERIC HEART VALVE

Scientists at the University of Cambridge have designed and manufactured a tri-leaflet heart valve made of polymers and mimicking tor the first time the unique anisotropic properties of natural tissue valves.

Key features:

- Combines the durability of mechanical valves and the haemo-compatability and flexibility of natural tissue valves.
- Manufactured by injection moulding – adapted to mass production of small polymer components, easy to use, excellent controllability and reproducibility
- Global market - $1.2 billion in 2011 & expected to reach $1.7 billion in 2015
- This technology could be developed to other types of heart valves, including transcatheter

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Background

Diseased and dysfunctional heart valves are routinely repaired or replaced through surgical intervention. If damage is too severe to enable valve repair, the native valve is replaced by a prosthetic valve. Over 290,000 heart valve procedures are performed annually worldwide and that number is expected to triple to over 850,000 by 2050. Current available heart valve prostheses are either mechanical or biological. Despite having excellent durability, current mechanical prostheses are prone to thromboembolic complications causing patients to require lifelong anti-coagulation therapy. Biological tissue-based valves (usually porcine or bovine in origin) exhibit good hemodynamic performance; however they are prone to calcification and tissue failure.

Polymeric materials could offer the optimal compromise between the use of mechanical valves and natural tissues; but as yet no clinically acceptable such polymeric valve has been manufactured. Suitable polymers are typically isotropic (identical orientation of the fibers in all directions) whereas a crucial property of natural healthy soft tissue, is their anisotropy: collagen fibres are arranged in different orientation to reinforce the tissue and provide the requisite structural integrity, while allowing for very thin leaflets that produce minimal pressure gradient across the valve.

Technology

Dr Geoff Moggridge, Dr Joanna Stasiak and Mr Jacob Brubert from the department of Chemical Engineering have shown that injection moulded cylindrical block copolymers (consisting of two or more polymer types) can be oriented efficiently in the direction of flow, giving directionally tailored mechanical properties. By this method it is possible to provide enhanced strengths in regions liable to high stress, giving mechanical reinforcement only where it is required while maintaining overall flexibility. Such an approach to producing anisotropic reinforced polymer structures mimicking the mechanical properties of natural tissues has never been attempted before.

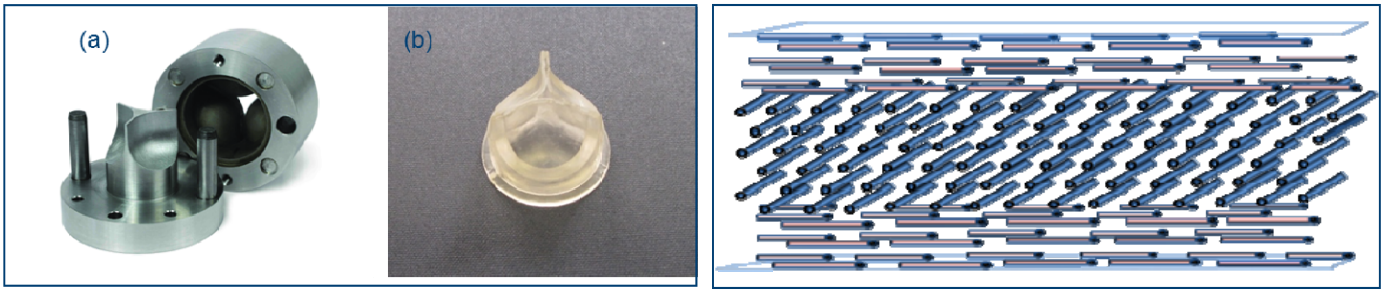

Figure 1 : a) Mould used for the fabrication of the valve by compression moulding (b) Valve prototype, produced from mould (c) Schematic of alignment within injection moulded sample as seen through a cross section.

Commercialisation

This technology is protected by a patent application (number 1403454.0) and we are seeking for a commercial partner for licensing, collaboration and development of this technology.