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Polyurethane medical implants improved by plasma immersion ion implantation

Polyurethane is used in medicine for permanently implanted devices due to its elasticity, mechanical strength, biostability, biocompatibility and hemocompatibility. However, the immune system recognises polyurethane as foreign and initiates an immune response that can result in a range of negative consequences as foreign body rejection, inflammation, pain and dysfunction of the implant. We use plasma immersion ion implantation for activation of the polyurethane surface to facilitate covalent binding of a biologically active protein layer and report on the results in application relevant assays.

A polyurethane composition with mechanical properties adjusted to soft tissue was developed to match the mechanical properties of the vasculature and ensure suitability for surgical suture. Plasma immersion ion implantation was performed to activate the surface. Mechanical properties of the structures were characterised with tensile testing whilst the chemistry and morphology of the surfaces were characterised by AFM, FTIR and XPS spectroscopy. The activated surface was then used to covalently immobilise bioactive protein molecules directly from solution. The immobilised protein layers were characterised with ELISA. The effects on cell adhesion in-vitro and on cellular responses in a mouse model of the ion treated materials both with and without protein immobilised will be reported.

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