Katarzyna Maksymow

Abstract

A manner in which biomaterials and blood acceptably co-exist has been extensively studied by scientists for many years. All surfaces except the undamaged vascular wall endothelium induce several processes that result in complement activation and thrombus formation. Importantly, the specific nature of biomaterial surface, both chemical and physical properties, determines how the living host tissue and whole organism interacts with implant during its life-time. Since millions of devices in contact with blood are used each year, biocompatibility plays a key role in preservation of health.

The aim of this study was to modify a surfaces of blood-contacting biomaterials in order to increase a hemocompatibility. An improvement of biocompatibility was obtained by fabrication of coatings based on titanium, carbon and silicon. Clinically applied poly(vinyl chloride) (PVC), used as a substrate, was covered by vapour-based methods. Physical properties of analysed samples were investigated mostly by microscopic techniques, including scanning and transmission electron microscopy, confocal microscopy and atomic force microscopy. Biomedical examinations were carried out for the sake of identifying coagulation system activation under near the physiological conditions. It was based on analysis of platelet adhesion and amount of thrombus formed during mutual, dynamic, blood-material interaction.

In this study an existing approach to biomedical novel materials was extended. As a result, physical and biomedical properties of different coatings were compared. It was revealed that in vitro dynamic interaction between blood cells and surface, is dependent on chemical composition and roughness of the coating. Surface defects formed during the arterial flow simulation do not promote the adhesion of blood cells to the surface. Considerable insight has been gained concerning unique biomedical materials fabrication and biocompatibility evaluation. Complex studies include designing process of advanced special-purpose material diagnostic from its manufacturing through an evaluation of its physicochemical properties and biocompatibility in contact with the human body. This methodology provides a powerful tool for general applicability to any biocomapatibility assessment for cardiovascular devices.

Download

Abstract (PDF)
Recenzja prof. A. Kotarby (PDF)
Recenzja prof. J. Marciniaka (PDF)