Editorial

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Hydrophilic Coatings for Biomedical Applications

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Hydrophilic coatings are applied to a wide range of surfaces of biomedical. This chapter addresses the need for coating in both in and ex-vivo settings for both blood contacting and non-blood-contacting applications, with illustrations of the coating chemistry used in each setting. Applications for non- fouling surfaces in diagnostics, lubricious surfaces on cardiovascular devices, and both lubricious and antimicrobial hydrophilic surfaces for urological applications are presented. Processes using both photochemical grafting and addiction cure technologies to generate hydrophilic surfaces are outlined, and a selection of polymers commonly employed in commercially available coating systems are considered and discussed in the context of the application area.

Hydrophilic coatings for biomedical application, and more specifically for medical devices, serve numerous purposes. This chapter focuses on application relevant to medical and medical related devices, with occasional reference to other applications.

The features chemistry of common polymers are explored, including covalently and non-covalently bound layers and interpenetrating networks. The relative merits of each approach, along with the advantages and disadvantages of a particular polymers are, illustrated. The chapter covers the application areas relevant to hydrophilic coatings and provide some back-ground and highlights of the favoured chemistries in each of these areas. They are split into in-vivo blood contact and non-blood contacting and ex-vivo, the division reflecting requirements in each applications area.

Examples of hydrophilic coatings

The requirement for coatings in-vivo and in-vitro are some what different from a regulatory perspective, despite the fact that the chemistry and the surface features desired can be substantially similar. In-vivo, the risk of failing on a regulatory pathway has a tendency to limit the selection of materials to well-tried, well-understood polymers, with known biocompatibility. As such, these basic polymers are to be found even in the most recently available coatings. The followings section describes the basic properties and features of these materials in an applied context.

Applications for hydrophilic coatings in the clinical environment

"Why do medical devices need a coating at all?", one must consider the application area and the problems or limitations a device or a practitioner with the device encounters. For instance, it is relatively common to coat guidewires used in percutaneous angioplasty with fluro polymers such as PTFE.

Such surfaces have a relatively low coefficient of friction and sufficiently blood compatible for the duration of the procedure. Without the PTFE, a bare metal part has too high a coefficient of friction and may suffer from biocompatible problems overtime due to changes in surface oxide upon storage. So what, if any, is the added advantage of a hydrophilic coating?

Creating a surface that is wetted by the environment into which it is inserted will facililtate insertion of the device, since the water layer present will act as a lubricant. Going a step further and optimising this surface so that it is, in the example, hemocompatible and tuning the properties of the coating towards a lower coefficient of friction with contact surface (the blood vessel) allows insertion of the device with considerably reduced force.