Polyurethanes at Biointerfaces

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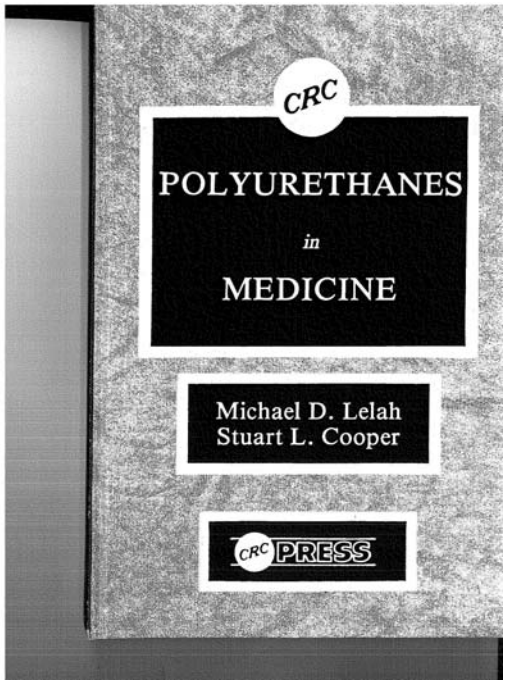
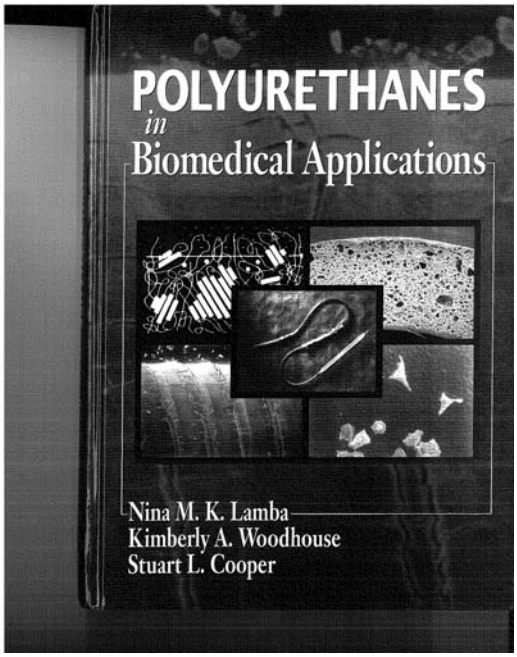
Polyurethanes have gained acceptance in the biomedical field because they have good physical properties and biocompatibility. The name "polyurethane" describes a class of polymers that can be synthesized to possess a variety of properties, from hard to brittle to very elastic. The polyurethanes that have found use in biomedical applications have elastomeric properties accompanied by good toughness, tear resistance and abrasion resistance. They have been widely used in applications such as intra-aortic balloon pumps, catheters and pacemaker lead insulation. The role of polyurethane's surface in the blood-material interaction will be described. Surface properties believed to affect biocompatibility include the interrelated properties of hydrophobicity, polarity and surface charge. The presence and mobility of microdomain surface morphologies may also affect protein adsorption and thrombus formation.



In an attempt to use polyurethanes in more demanding applications, we have modified their structure to include functional groups, which have the potential to exhibit bioactivity. Polyurethanes containing sulfonate groups exhibit hydrogel and anticoagulant behavior compared to unmodified polyurethanes. The sulfonated polyurethanes affect the ability of fibrinogen to polymerize and they consume thrombin, an important enzyme in the coagulation pathway.



Progress in understanding the interactions of the Arg-Gly-Asp (RGD) peptide sequence and integrins has stimulated a great deal of interest in the development of novel biomaterials, which may improve endothelial cell attachment and growth. Rather than immobilization of peptide to the polymer surface, an alternative approach was taken in that a polyurethane block polymer was modified so that it contained free carboxyl groups (PEU-COOH). Two cell adhesive peptides, GRGDSY (based on the fibronectin sequence, RGDS) and GRDVY (based on the vitronectin sequence RGDV), and an inactive peptide GRGESY were then grafted to the polyurethane backbone through the formation of amide linkages. The effects of peptide incorporation on polymer surface properties and endothelial cell adhesion were evaluated.