

Polyelectrolyte multilayers on Nitinol

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INTRODUCTION: Surface treatment plays an important role for increasing the overall biocompatibility of devices as stents or implants. Unlike restenosis, which is fairly common, stent thrombosis is a rare but much more dangerous complication after coronary stent placement. It usually occurs before endothelialisation has been completed. To improve the risk of stent thrombosis fast endothelialisation is necessary. For that reason, we deposited and mineralized Calcium Phosphate on Nitinol stent devices in a polyelectrolyte multilayer film from Chitosan and Heparin.

METHODS: Nitinol (an acronym for Nickel Titanium Naval Ordnance Laboratory) is a shape memory alloy and is already used for stents and implants.

The multilayer films are constructed by using the layer-by-layer (LbL) technique as shown in figure 1 [1, 2]. During LbL deposition, Nitinol, a solid substrate bearing negative charges on the surface, was initially immersed into a cationic polyelectrolyte solution. The substrate containing the cationic layer was subsequently immersed in the anionic polyelectrolyte solution. We used the two natural polysaccharides Chitosan and Heparin as polycation and polyanion respectively. Chitosan is a linear polysaccharide produced commercially by deacetylation of chitin. Heparin, also a linear polysaccharide, is widely used as an injectable anticoagulant.

After LbL deposition Calcium Phosphate was mineralized on the new surface. Hydroxyapatite may have advantageous effects for endothelialisation.

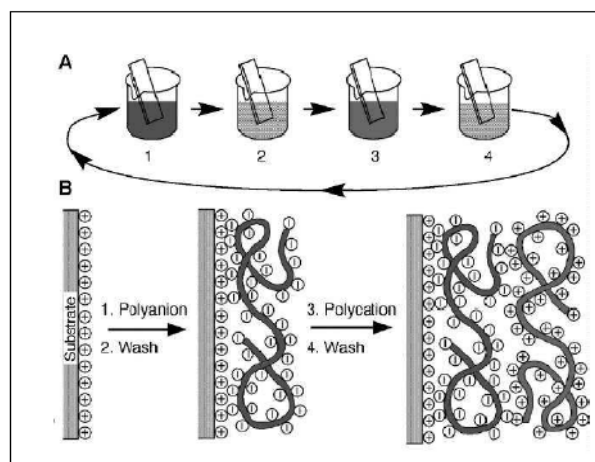


Fig. 1: Layer-by-Layer (LbL) deposition technique. Step 1 and 3 represent the adsorption of a polyanion and polycation, respectively, step 2 and 4 are washing steps [1].

RESULTS: The deposition of Calcium Phosphate on Nitinol substrate in general is possible even without a polymer. With the use of the polymer matrix, however, Calcium Phosphates deposits faster. On SEM images we can see explicitly more Calcium Phosphate crystals.

Secondly we investigated the concept of using the polymer multilayer as matrix and porous membrane for drug deposition. For this reason we did some LbL depositions adding Rhodamine and/or Oxonol as model for drug molecules. UV/Vis experiments show linear release of these chromophors over a time period of several weeks.

REFERENCES: ¹ G. Decher, *Science* 1997, 227, 1232. ² F. N. Crespilho, *Int. J. Electrochem. Sci.* 2006, 1, 194.