



## Polyelectrolyte Multilayers as a Responsive Coatings for Implant Surfaces

*NMI Natural and Medical Sciences Institute at the University of Tübingen*

# NMI

Applied R&D

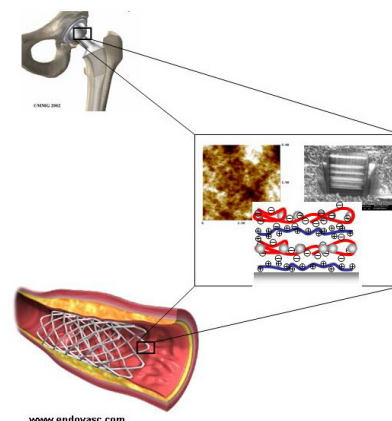
### BACKGROUND and BASICS

Responsive implant (e.g. stents or joints) surfaces coatings:

- can protect the implants from formation of biological films
- can be used as self eluting system to supply in controlled way the tissue neighbouring the implant with medicines necessary for the healing process.

Compartmentalised complex polyelectrolyte (PE) multilayers (PEM) can be used as implant coatings as they allow complex well-ordered drug loaded structures to be obtained.

PEM can be used to accommodate different species varying from metal nanoparticles via medicines to bioactive molecules like growth factors or enzymes. Incorporation of metal particles allows for preparation of layers which are responsive to electric or magnetic fields. The release of medicine can be tuned by the stability of the PEM coating. The biocompatibility of the implants, their resistance to bio film formation or acceleration of the healing process can be controlled.

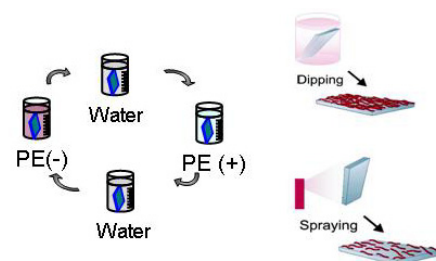


### CONCEPT and SOLUTION

The PEM coatings are prepared using the Layer-by-Layer (LbL) deposition technique based on the electrostatically driven adsorption of PE onto charged surface.

PEM can be prepared by sequential adsorption of polyions by dipping the surface activated substrate in solutions of PE or by spraying PE solutions onto a sample. Thus, even very complex surfaces can be coated.

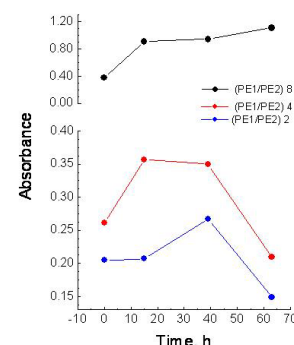
Large variety of polyanion/polycation can be used for coatings preparation e.g. PEI, Alginate, Chitosan, Hyaluronan, PLL etc. The layers are with very high stability to mechanical stress, chemical or biological driven degradation but they can be tuned to be sensitive to the changes of the pH or salt concentration in their surrounding. Active species (e.g. medicines, growth factors or enzymes) can be immobilised at the implant.



### STATUS and OUTLOOK

- First experiments with a medical tested PE couple are performed.
- The kinetics of release of active components from the surface is proved.
- The release kinetics strongly depends on the preparation conditions.

Further experiments with different polyelectrolytes and active species are foreseen. The deposition conditions will be precisely tuned to obtain long time-release kinetics.



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