

## Bloodcompatible Titaniumoxide-Coatings

### Background:

More and more foreign materials are inserted into the blood stream. For their use it is required that they don't induce the formation of blood clots.

### Objective:

- (1) Comparison of different Ti-oxide coatings (crystalline TiO<sub>2</sub> [rutile or brookite], amorphous TiO<sub>2</sub> and Ti<sub>2</sub>O<sub>3</sub>) to check the influence of the crystal structure on blood clotting
- (2) Effects of ion beam modification of Ti oxide layers to the bloodcompatibility
  - <sup>31</sup>P doping (5x10<sup>15</sup> cm<sup>-2</sup>) (II-P) to change the semiconductive properties
  - <sup>52</sup>Cr doping (5x10<sup>17</sup> cm<sup>-2</sup>) (II-Cr) for surface passivation.
  - Post implantation annealing (II-P 900°C)

### Methods:

Titanium oxide coatings were fabricated by reactive metal plasma deposition of Ti on Si. Different crystal structures were obtained by controlling temperature, bias voltage and oxygen flow.

### Parameters for the investigation of bloodcompatibility:

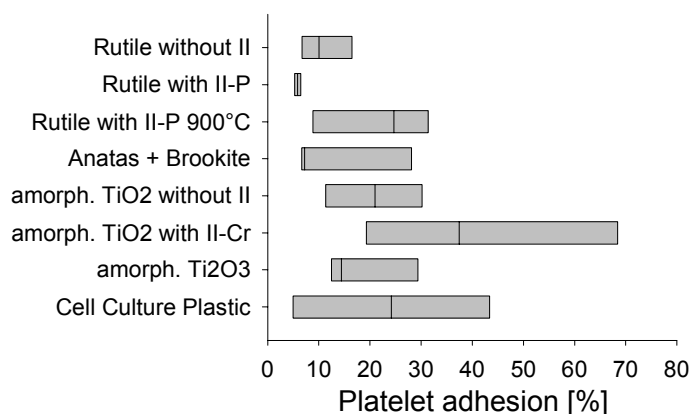
- Expression of the activation marker P selectin (CD62P) on blood platelets
- Quantification of adherent platelets by the lactat dehydrogenase method
- Morphology of adherent platelets by scanning electron microscopy
- Clotting time with human standard plasma

### Conclusion:

The crystalline structure of the titanium oxide has no influence on blood compatibility. A P<sup>+</sup> implantation improves the cellular as well as the humoral blood compatibility of titanium oxide, whereas Cr<sup>+</sup> ion implantation reduces plasma clotting activation but increases platelet activation. It is under investigation whether the phosphate effect has an electrical or biochemical nature.

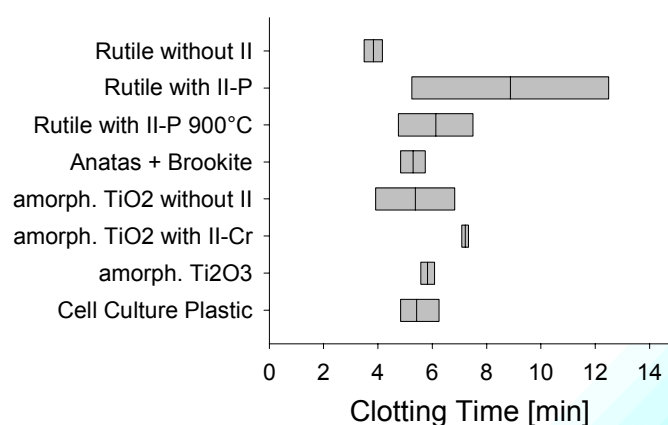
### Results:

#### (1) Blood platelets



- **P<sup>+</sup>-Implantation:**  
**Reduced** platelet adherence and activation according to marker expression and morphology
- **Cr<sup>+</sup>-Implantation:**  
**Increased** platelet adherence and activation according to marker expression and morphology

#### (2) Plasma Clotting Time



- **Both P<sup>+</sup> and Cr<sup>+</sup> implantation:**  
 Reduced clotting activation !!