FORSCHUNGSZENTRUM ROSSENDORF
Institut für Ionenstrahlphysik und Materialforschung

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_2 [rutile or brookite], amorphous TiO_2 and Ti_2O_3) to check the influence of the crystal structure on blood clotting

(2) Effects of ion beam modification of Ti oxide layers to the bloodcompatibility

- ^{31}P doping ($5x10^{15}$ cm^{-2}) (II-P) to change the semiconductive properties
- ^{52}Cr doping ($5x10^{17}$ cm^{-2}) (II-Cr) for surface passivation.
- Post implantation annealing (II-P 900°C)

Methods:

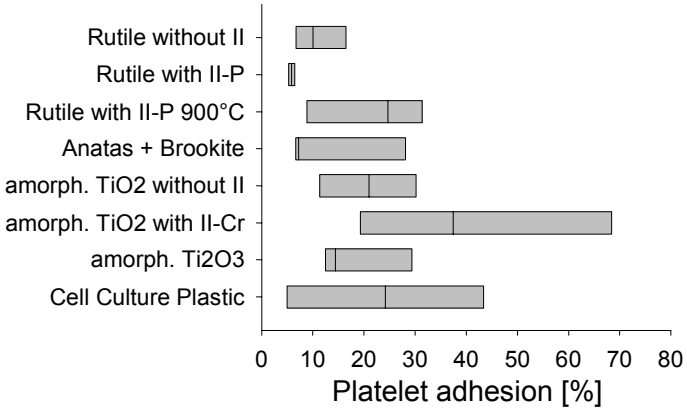
Titanium oxide coatings were fabricated by reactive metal plasma deposition of Ti on Si. Different crystal structures were obtained by controlling temperature, bias voltage and oxygen flow.

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

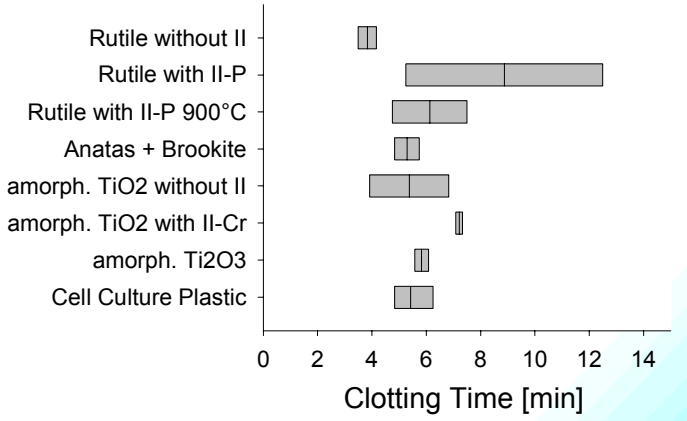
Results:

(1) Blood platelets



- **P^+-Implantation:**
  Reduced platelet adherence and activation according to marker expression and morphology
- **Cr^+-Implantation:**
  Increased platelet adherence and activation according to marker expression and morphology

(2) Plasma Clotting Time



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

Conclusion:

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

Ansprechpartner: Dr. Manfred Maitz Tel. (0351) 2 60 2014 m.maitz@fz-rossendorf.de
Dr. Igor Zyganov, TU Lipetsk, 398055 Lipetsk Russia i.zyganov@fz-rossendorf.de

Postfach 51 01 19
D - 01314 Dresden
www.fz-rossendorf.de