

*This work was supported by NSFC39770212 and NSFC39870199

IUMRS-ICAM'99, Beijing, CHINA Symposium: S, June 14-18, 1999
(Organiser: Chinese Materials Research Society)

A DEVELOPMENT OF SURFACE MODIFICATION OF ARTIFICIAL HEART VALVE MATERIAL

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Blood coagulation is a most concerned problem for mechanical artificial heart valve (MAHV) material. Although low temperature isotropic pyrolytic carbon (LTIC) have been popularly applied as typical material for MAHV since the end 1970's, the blood compatibility is still not meet the need of clinical requirement ideally. Researchs on surface modification of MAHV materials have been performed such as TiN film, diamond like carbon film, SiC film etc. In this paper a author's series works on surface modification of MAHV materials were described

After preliminary investigation of blood compatibility of titanium oxide layer with rutile structure, we synthesized non-stoichiometrical titanium oxide film of amorphous structure by ion beam enhanced deposition (IBED). Clotting time measurement, Platelet adhesion, hemolysis etc shown that the better blood compatibility of Ti-O film than LTIC. The investigation on the behavior of blood coagulation with the change of structure from amorphous to rutile structure shown further improvement of blood compatibility. Consideration of durability of the surface modification, complex films of Ti-O/Ti-N were synthesized and excellent mechanical properties were proved through the studies of bonding strength between films and the titanium matrix by scratch test, fatigue behavior by three bending experiment, and wear properties by pin on disk testing.

To understand the behavior of blood compatibility of Ti-O material system, Ta, Nb etc doped titanium oxide films were synthesized by sputtering. blood compatibility in vitro and in vivo were performed systematically. the results further shown excellent anticoagulation characteristics of Ti-O material system over LTIC.

The mechanisms of the blood compatibility of Ti-O material system were discussed in the point of view of prevent adsorption of fibrinogen on the surface of the material and prevent denaturation of the protein.