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Blood compatibility of TiO2-x films synthesized by PIII [#]

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In China, valvular problems account for 30% of heart diseases, and 100,000 patients need new heart valves every year. Currently, low temperature isotropic pyrolytic carbon (LTIC) is the best material for artificial heart valve, but it is brittle and its blood compatibility is still not sufficient for prolonged clinical use. As a result, thrombus often occurs, and patients need to take anti-coagulation drugs. Hence, a new material with good blood compatibility as well as mechanical durability is needed by the biomedical industry. Titanium oxide films have the desirable properties as an artificial heart valve material, and in this work, we investigate the properties of titanium oxide films synthesized by titanium metal plasma immersion ion implantation (PIII) and reactive plasma oxidation. By controlling the deposition rate of titanium and density of the oxygen plasma, TiO_{2-x} films with various Ti to O ratios can be fabricated. The chemical composition of the titanium oxide films is measured by Auger electron spectroscopy (AES), and the elemental chemical states are determined by x-ray photoelectron spectroscopy (XPS). The blood compatibility of the TiO_{2-x} films is evaluated by clotting time measurement, thrombin time, prothrombin time test, and platelet adhesion investigation. Our results show that the TiO_{2-x} films prepared by metal PIII and reactive plasma oxidation display blood compatibility much better than that of LTIC, and that the TiO_{2-x} films of a certain Ti to O ratio have optimum blood compatibility. Our mechanical testing data show that the micro-hardness of the TiO_{2-x} films reaches 1000kg/mm2 or above and the wear resistance is similar to that of titanium nitride films.

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