BIOCOMPATIBLE CARDIOVASCULAR IMPLANTS

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Coronary implants has been used for the revascularization of occluded coronary arteries, but bare metal stents often caused restenosis by thrombosis grown onto the stent. For the increase of biocompatibility decreasing the restenosis effect, the coating layer based on diamond-like carbon film (DLC) is deposited on the implants surface. DLC films have found widespread application in biological coatings for their chemical and temperature stability. Diamond-coated medical nanocrystalline steel has shown a high level resistance to blood platelet adhesion and thrombi formation [1]. DLC coatings have successfully been proposed for applications as artificial heart valves, catheters, stents, etc.,[2].

In this work we present the microstructural control results of the Ti/DLC nanocomposite coatings fabricated by magnetron sputtering. deposited on nonannealed and annealed 316LF stainless steel. Annealing was performed according the technology sequence for stents-electropolishing and high temperature annealing for grain enlargement and improving of the stents elasticity. The following analytic methods were applied SEM, AFM and XPS. The high temperature annealed stainless steel morphological analyses demonstrated the essential grain enlargement 10 to 60 μm, which is necessary for the required elasticity of the arterial stents.

The XPS analyses have shown that the intensity of the sp3/sp2 lines decreases with the depth from the surface, Fig. 1. It can be due to decreasing of the layers thickness or due to surface amorphisation after the argon sputtering of the layers.
The AFM study of DLC layers deposited at high temperatures on stainless steel shown that the roughness is up to 300 nm on nonannealed substrates and up to 3500 nm on annealed substrates. The roughness on nonannealed samples is due to the nonpolished surface, while on the annealed substrates to the much larger grain size after annealing.

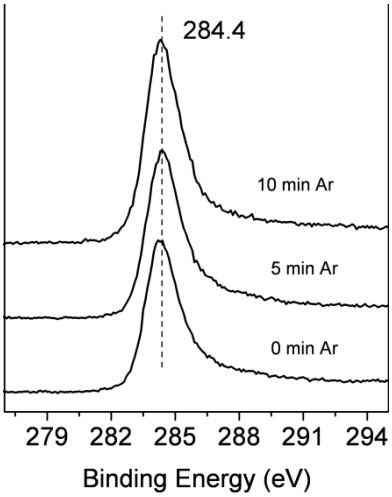

Fig. 1. XPS analysis of the deposited DLC layer.

Rapid photothermal processing has been performed at 300°C-700°C. The RPP at 300°C and the furnace annealing at 400°C up to 3 min do not change essentially the carbon content, but RPP at higher temperature 350°C-450°C essentially changed the carbon content.

The reliable technology for magnetron deposition of biocompatible Ti/DLC nanolayers for coating of implantable medical devices has been established. RPP at 400°C improved the microstructure and properties of deposited coatings.

[1] W. Okroj, et al. Blood platelets in contact with nanocrystalline diamond surfaces. *Diamond & Related Materials* 15, 10, (2006), 1535-1539.

[2] A. Grill Diamond-like carbon coatings as biocompatible materials —an overview. *Diamond & Related Materials* 12, 2, (2003), 166-170.