Frontiers Annual Meeting 2005, Karlsruhe

PYROLYTIC CARBON COATED STENTS INVESTIGATED BY ATOMIC FORCE MICROSCOPY

Andreas Pfrang[1,*], Thomas Schimmel[1,2]
[1] *Institute of Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany*
[2] *Institute of Nanotechnology, Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany*

**Corresponding author e-mail address: info@pyrocarbon.de*

348<300-350 words

Vascular stents play an important role for the treatment of arteriosclerotic diseases. A majority of these stents consists of chromium-nickel stainless steel, mainly because of this material's good mechanical properties and good processibility. Two major problems for stenting therapy are the thrombogenicity of the stents and the formation of additional tissue that can lead to a narrowing or even sealing of the vessel.
One possible approach to improve stent performance is the coating of steel stents with a biocompatible layer. We investigate stents (steel 316L) coated with pyrolytic carbon by chemical vapor deposition. CVD was carried out in a hot wall reactor at temperatures between 600°C and 700°C from a gas mixture consisting of methane, argon and hydrogen.
The surface morphology of the pyrolytic carbon surfaces was investigated by atomic force microscopy in dependence of the deposition parameters. Lateral force microscopy and force modulation microscopy were applied to get insight into the homogeneity of the surface properties of the pyrocarbon layers. A method for determining the adhesion of individual carbon islands on substrates is presented.
Chemical contrast imaging by AFM exhibits chemically homogeneous surfaces. The surfaces show a roughness on the micrometer scale that depends strongly on the deposition parameters. On a smaller length scale a granular substructure with typical island sizes ranging from 100 to 200 nm were observed on all surfaces investigated. This granular structure has also been observed on pyrolytic carbon layers deposited at higher temperatures on other substrates and is found to correlate with the degree of texture of the pyrolytic carbon layers.

[1] B.S. Rhee, M.Y. Rhee, K.J. Hüttinger. CVD-kinetics of pyrolytic carbon from methane on the stainless steel 316L at 600 °C. In: Carbon '01, 25th Conference on Carbon, Extended Abstracts (2001), 9.5.
[2] A. Pfrang, K.J. Hüttinger, Th. Schimmel. Adhesion Imaging of Carbon Fiber Reinforced Materials in the Pulsed Force Mode of the AFM. Surface and Interface Analysis 2002; 33(2), 96-99.
[3] A. Pfrang, B. Reznik, Th. Schimmel, D. Gerthsen. Comparative Study of Differently Textured Pyrolytic Carbon Layers by Atomic Force, Transmission Electron and Polarized Light Microscopy. Carbon 2003; 41(1), 181-185.