STUDYING THE BEHAVIOR OF Ti-O-N COATINGS OF CORONARY STENTS IN TISSUE FLUIDS

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Currently, coronary stenting is one of the most effective methods of myocardial revascularization, that is restoration of blood supply to a particular area of the heart muscle. There are several generations of stents: stents using pure metal, stents with a polymer coating, with a drug coating, bioresorbable stents. One of the most effective technologies of stent surface modification is to apply a coating of titanium oxynitride. TiON coating reduces platelet adhesion and fibrinogen binding compared to the stent material (stainless steel) [1]. Also because of to the electrochemical effect of the protective coating, the tendency to corrosion of implants in body fluids (blood, lymph, interstitial fluid) decreases significantly.

The object of our study are biocompatible TiON films deposited by reactive magnetron sputtering on the experimental installation "UVN-200MI" (TPU, Tomsk) [2]. A substrate for the application of unilateral coatings – Crystal KBr.

Purpose – to study the behavior of Ti-O-N coatings in the tissue fluids: dissolution / chemical and physical durability.

For studies, as a model biological fluid physiological solution NaCl (0.9%) was used. The solvent volume of NaCl (4 мл) was determined according to the area of the sample (2 cm^2) according to the recommendations of GOST R ISO 10993-12-2009 [3]. Test samples of TiON coatings were kept for 30 days in NaCl (0.9%).

Further samples were removed; the solution was filtered using "blue tape", and analyzed to detect elements of the covering. For these purposes, we used atomic-emission analysis (AEA) – a method for determining the elemental composition of substances by optical emission line spectra of atoms and ions of the sample excited in light sources. The choice fell on this method of analysis, as compared with other optical spectroscopic and many chemical and physico-chemical methods of analysis it is possible to contactlessly, rapidly determine a large number of elements over a wide concentration range with acceptable accuracy using a small sample mass.

The analysis was performed on a device of atomic-emission spectrometer ICAP 6300 Duo. As standard, reference solutions, state standard samples MES-1 and MES-2 were used. AEA results are shown in Table 1.

Table 1. Results of the AEA-analysis of the sample after 30 days

measuring the number	The concentration of elements in the test solution, mg/l		
	Na	K	Ti
1	119600	44.53	0.0005
2	120500	44.22	0.0006
average value	120000	44.38	0.0005

It is evident that with decreasing concentrations of an element in a series of samples of the same composition, the intensity of the spectral lines of the element in the corresponding spectra is reduced on the condition that the excitation parameters are held constant and spectra are recorded [4]. Since the spectral lines belonging to a particular element have different intensity, by decreasing its concentration weaker lines will disappear in the spectrum before the more intense ones. As a result, according to the absence of some lines in the spectra and the presence of other more intense lines of the given element, one may conclude about its concentration in the sample.

The experimental data have identified the presence of ions in solution of such elements as Na, K, Ti. A large number of Na is due to the use of NaCI as solvent. The minimum amount of Ti confirms chemical resistance of oxynitride coating $TiNO_X$.

References

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THE STUDY OF COAL-WATER SLURRY ON THE BASIS OF BROWN COAL WITH THE ADDITION OF NANO-SIZED CARBON GLOBULES

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The basis of coal-water fuel studed in this work is a highly concentrated (50 wt.%) slurry (CWS). The dispersed phase is finely-powdered Kansk-Achinsk coal, the dispersion medium is distilled water. The novelty of the investigation lies in the fact that low concentrations (0.04, 0.08, 2 wt.%) of nanoglobular carbon (carbon black T-900) were added instead of amphiphilic surface-active agents (surfactants), which are injected in CWS in order to regulate its physico-chemical, structural-mechanical (rheological) properties.

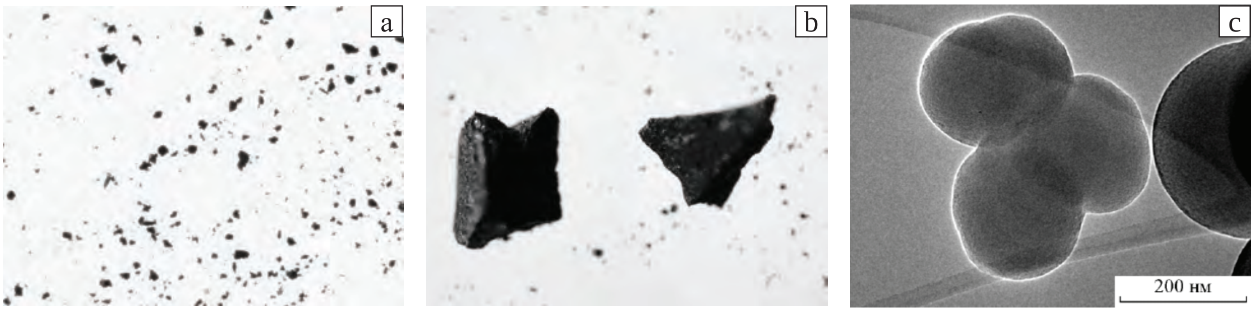

Fig. 1. *Shape of dispersed particles of CWS: a – carbon powder, b – carbon particles, c – carbon globules*

The form of coal particles is developed or bluff, the size – 50 mkm … 3.8 mkm (bimodal distribution). The shape of the particles of carbon black is streamlined, the globules. The average size is about 160 microns (initial) but less than 100 nm in CWS (Figure 1).

Carbon black grade is selected by the efficiency of its absorption of polyurethane. [1]

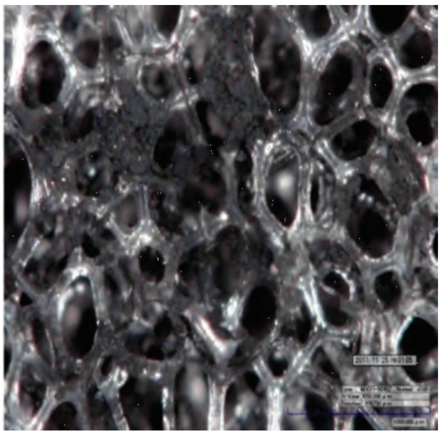

Fig. 2. *Polyurethane sample after the impregnation of the carbonaceous slurry*

The curves of dynamic viscosity (viscometer Reotest-2) are similar to a non-Newtonian fluid's curves (Figure 3). They are approximated by pow-