FORMATION OF THE SILICON COATING ON THE NITI SUBSTRATE BY MAGNETRON SPUTTERING[i]

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This study considers the possibility of using silicon as a coating on a NiTi vascular stent. It is assumed that the porous structure will be obtained on this coating in the future. In turn, it will serve as a carrier for the drug. Silicon is one of the most common material in the nature. Because of its spread, easy obtaining, thermophysical, electrophysical and chemical properties, there is an advantage to use the silicon coating in various fields of science, medicine and technics [1].

At this study, the research of structure and properties of a silicon cover was conducted. The silicon cover was gained on the NiTi substrate by using the magnetron sputtering. NiTi containing 50.9 at. % nickel was chosen as a substrate because of the use this material for making cardiovascular implants. Silicon targets of 99.999 % purity were used for silicon coating. Deposition of Si on the NiTi substrate was performed by RF-magnetron sputtering. Argon was used as an inert gas. During the coating deposition, the working pressure in the vacuum chamber was 0.7 Pa. The distance between the target of cathode and the condensable surface on the NiTi substrate was 70 mm. The treatment was conducted for the creation of surface with diverse thicknesses by the using of different modes: mode I (P=250 W; t=120 min); mode II (P=250 W; t=15 min); mode III (P=150 W; t=15 min); mode IV (P=100 W; t=15 min). An electron microprobe (EMP) was performed for the study of coated samples (Fig. 1 a), microhardness was studied as well (Fig. 1 b).

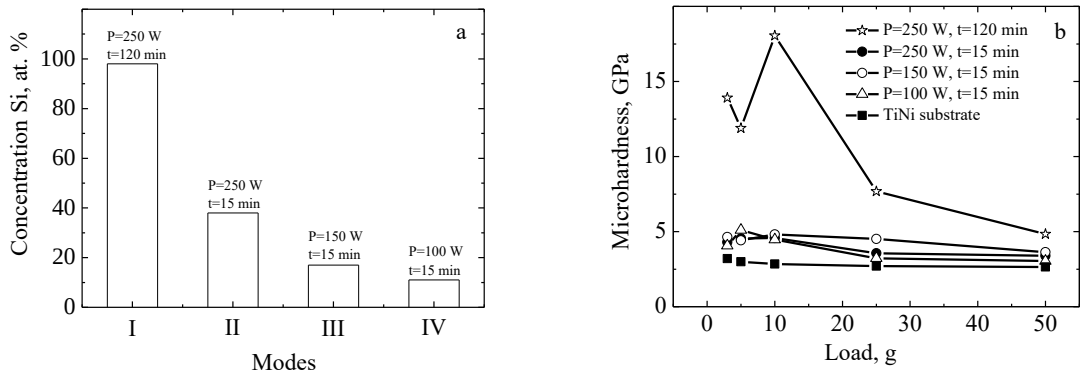

Fig. 1. The concentration of silicon in the surface layer of samples depending on the mode of sputtering (a); the microhardness of modified samples depending on the value of indenting load (b).

Microhardness was measured with various loads from 3 to 50 g. The analysis of results shows that the thickness of obtaining covers depends on the modes. It is noticed that due to the concentration of silicon in samples' surface layers. The area of X-ray generation in EMP does not exceed a depth of 5 μm for silicon. It means that the surface layer obtained in mode I with the silicon concentration of 98 at. % has comparable thickness of 5 μm. Such thickness is enough for creation of porous structure for the carrying of drug. The value of load defines the depth of dent and describes mechanical properties. It is supposed that the surface obtained by mode I has the biggest thickness and microhardness similar to silicon. Other samples have microhardness similar to NiTi. It means that the dent depth exceed the thickness of layer and does not influence on the value of microhardness.

Thus, the use of magnetron sputtering allows to receive a silicon cover on a nitinol substrate, where the obtaining thickness is enough for creation the porous structure. It is identified that the time of treatment has more influence on cover thickness than the power of magnetron.

REFERENCES

[1] *Klyueva V.A. // Young Scientist. – 2016. 10(114). P. 236–245.*

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