P31

Creation of thin superconducting MoCN covering by cathode sputtering technique as a basis film for functional cryogenic nanoelements

B.A. Gurovich[1], B.V. Goncharov[1], L.V. Kutuzov[1], K.E. Prihodko[1,2], E.D. Olshansky[1]

[1]*NRC "Kurchatov Institute", 123098, Moscow, Russia*
Bvgoncharov@gmail.com

[2]*National Research Nuclear University "MEPhI", 115409, Moscow, Russia*

At present, studies of thin superconducting films as a basis for nanoscale electronic devices (such as single-photon detectors) are of great interest in connection with high values of critical current densities (3-6 MA/cm^2) and relatively high superconducting transition temperatures (12-14 K). Nowadays many type of thin film superconductive materials (NbN, MoN, MoC) are used to build up SSPD and HEB devises. However, with the rapid development of cryoelectronics, the search for new materials remains urgent.

Films made by cathode sputtering were used to create molybdenum carbonitride (MoCN) of various thicknesses on SiO_2 substrates using a Mo and C mosaic target. Sputtering carried out in a nitrogen atmosphere at temperature of 800 ºC. Formation of structures for electrical measurements was performed by electron lithography and plasma-chemical etching, followed by deposition of Ni-Pt contacts.

The dependence of resistance on the temperature was measured in the temperature range 4.2-300 K. It was found that the obtained material showed superconducting properties. It was investigated the dependence of superconducting state transition temperature dependence on the film thickness as well as the dependence of the transition critical current on the temperature in the temperature range 4.2-13 K.

The thicknesses of the films was measured by bright-field TEM technique on the FIB cut cross-section samples. Chemical elements depth distribution profiles were measured by EELS technique in STEM mode of transmission electron microscope with accuracy of the electron probe size (~0.15 nm). We used 0.5 nm step size to get the chemical elements depth distribution profiles.

The work was supported by the NRC "Kurchatov Institute" (№1639).

1. B.A. Gurovich, K.E. Prikhod'ko, M.A. Tarkhov, et al., *Nanotechnol. Russia* **10**, 530 (2015).
2. B.A. Gurovich, M.A. Tarkhov, K.E. Prikhod'ko, et al., *Nanotechnol. Russia* **9**, 386 (2014).
3. B.A. Gurovich, K.E. Prikhod'ko, E.A. Kuleshova, et al., *J. Exp. Theor. Phys.* **116**, 916 (2013).
4. K.E. Prikhodko, B.A. Gurovich, D.A. Komarov, et al., *Nucl. Instr. Meth. Phys. Res. B* **326**, 273 (2014).
5. J.F. Ziegler, M.D. Ziegler, J.P. Biersack, *Nucl. Instr. Meth. Phys. Res. B* **268**, 1818 (2010).
6. A. Gilewicz, R. Jedrzejewski, A.E. Koshmanska, B. Warcholinski., *Thin Solid Films* **577**, 94 (2015).