SANS RESEARCH OF HEAT-RESISTANT NONMAGNETIC ALLOYS AT NEUTRON REFLECTOMETR - SANS INSTRUMENT «GORIZONT» IN INR RAS

V.S. Litvin[1], D.A. Buchnyi[1], A.V. Churakov[2], D.N. Trunov[1], S.N. Axenov, R.A. Sadykov[1], V.I. Bodnarchuk[1] and A.V. Belushkin[1]

[1]*Institute for Nuclear Research RAS, Moscow, Russia*
[2]*Joint Institute for Nuclear Research, Dubna, Russia*

E-mail: vlitvin@inr.ru

It is planned to carry out in situ measurements at high pressures at the neutron instruments at the Institute of Nuclear Research RAS. Using the SANS method, the structure of non-magnetic alloys based on Ni, Mo, and Cr was studied at the Gorizont setup. These alloys are of interest as a material for the manufacture of high-pressure cell for research in magnetic fields by neutron methods. The measurement of SANS spectra on samples of such alloys is necessary to select the optimal material for manufacturing cell. SANS spectra obtained on heat-resistant alloys 40HNU (Ni — base, Cr — 40% and Al — 3,5%), Be-bronze (Cu — base, Be — 2% , Ni — 0,2-0,5%) and MoTiC-alloy (Mo — base, Ti — 10%, C — 3%) presented at fig. 1. The Gorizont instrument at the IN-06 pulsed neutron source of the INR RAS [1] is designed to study two-dimensional nanostructures, such as multilayer nanofilms, by neutron reflectometry. Thanks to the vertical scattering plane, liquid samples, such as films on the surface of a liquid, can be examined. This device can also be used for studies of small-angle neutron scattering (SANS). The device consists of a 7-meter curved neutron guide, automatic collimator slits, a deflecting non-magnetic NiMo/Ti supermirror with $m = 2$ (which can be replaced by a polarizer), and a vibration-resistant sample. The facility is equipped with a two-coordinate monitor and a two-coordinate neutron detector manufactured by FLNP of JINR.

It can be concluded from the obtained spectra that the SANS cross section of the Be-bronze is one order of magnitude and MoTiC-alloy is two orders of magnitude smaller than that of 40HNU and, therefore, it is better for use in neutron diffraction measurements.

The results were obtained with the financial support of the Russian Federation represented by the Ministry of Science and Higher Education, an agreement № 075-10-2021-115 from 13/10/2021 (№ 15.СИН.21.0021).

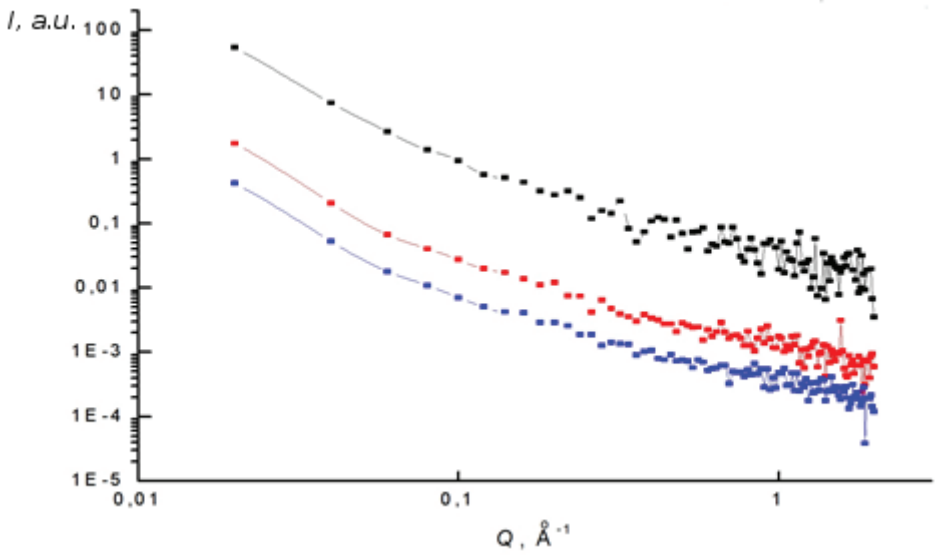

Fig. 1. SANS at 40HNU(black), Be-bronze (red), MoTiC-alloy(blue).

[1] V.S. Litvin, V.A. Trounov, V.A. Ulyanov and others (2012). A new time-of-flight neutron reflectometer and SANS instrument GORIZONT at IN-06 spallation neutron source. Journal of Physics: Conference Series, 340, 012032.
[2] V.S. Litvin, (2021). Simulation and Test Measurements Using Neutron Reflectometer and Small-Angle Spectrometer “Horizon” Operating at the IN-06 Pulsed Source. Journal of Surface Investigation: X-ray, Synchrotron and Neutron Techniques, 4, 645-651.