RESULTS OF MODERNIZATION OF THE FSS NEUTRON FOURIER DIFFRACTOMETER AT THE IBR-2 REACTOR

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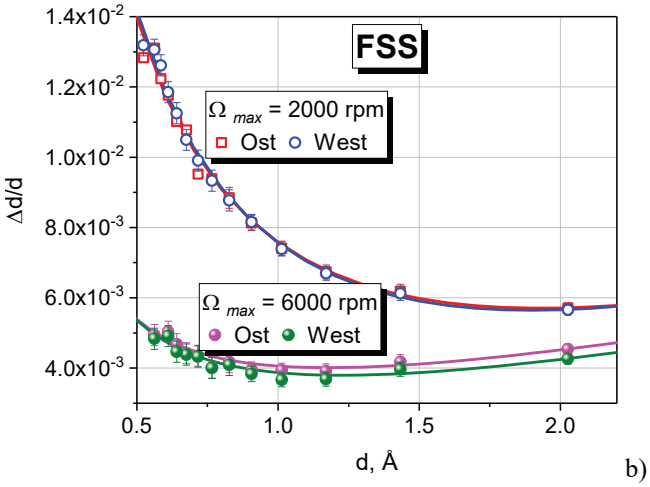
Neutron Fourier diffractometer FSS (Fourier Strain Scanner) was used in 1990-2010 at the stationary reactor FRG-1 at the GKSS research center (Geesthacht, Germany) to study residual stresses in structural materials and industrial products. In 2010, the FRG-1 reactor was finally decommissioned. In this regard, in 2014 the FSS diffractometer was transported to FLNP JINR (Dubna, Russia) and located on channel No. 13 of the IBR-2 pulsed reactor.

Over the past few years, a large amount of work has been carried out to build beamline No. 13, develop its infrastructure, create biological schielding, as well as install and adapt the main FSS units to work on a pulsed source and perform the first test experiments. At the next stage, a new neutron guide with a supermirror coating (m = 2), radius of curvature R = 1900 m, and characteristic wavelength λc = 0.95 Å was installed at the FSS.

To improve the resolution of the FSS, a new Fourier chopper with a maximum rotation speed of Ω_{max} = 6000 rpm was installed. The new chopper is mounted on a movable platform, which allows the chopper to be remotely inserted and removed from the beam as needed, and thus quickly switch between TOF (high intensity) and RTOF (high resolution) modes. The results of test experiments showed that after the replacement of the chopper, the FSS resolution improved significantly (Fig. 1). In addition, old DAQ electronics was replaced with new MPD-32 RTOF analyzers for data accumulation in the list-mode, which allows one to set the necessary parameters of the TOF scale and ensure high accuracy of electronic focusing for individual detector elements.

Thus, the main work on the adaptation and modernization of the FSS diffractometer has been successfully completed. Further development of the FSS includes work on increasing the luminosity of the diffractometer, reducing the background level, improving the Fourier analysis parameters, and equipping the diffractometer with additional devices (loading machines, furnaces, etc.) to provide the external conditions on the sample.

a)



b)

Fig. 1. a) The new Fourier chopper of the FSS diffractometer, mounted on a movable platform. b) Comparison of the resolution functions Δd/d, measured with a standard iron sample with old (Ω_{max} = 2000 rpm) and new (Ω_{max} = 6000 rpm) choppers.