

## 2. NEUTRON SOURCES

### THE IBR-2 PULSED REACTOR

In 2011, the activities on the IBR-2 research reactor were carried out in accordance with the tasks of the theme “Development of the IBR-2M reactor with a complex of cryogenic neutron moderators” with the maintenance of the regular operation of all reactor systems. Upon the completion of modernization of the IBR-2 reactor in 2010, during 2011 the physical startup was conducted in steady-state and pulsed modes followed by a successful power startup with the achievement of the designed power of 2 MW. In November-December two cycles of test physical experiments were performed on the extracted neutron beams at the reactor power of 2 MW in order to obtain more accurate and specific user characteristics of the modernized reactor. Also, a set of documents necessary for obtaining the Rostekhnadzor license for the regular operation of the reactor has been prepared.

The program of the physical startup of the modernized IBR-2 reactor included the experiments aimed at determining the actual values of the critical parameters of the reactor core, the efficiency of the reactor control units, safety systems, the duration of power pulses and their amplitude fluctuation, as well as a number of other physical characteristics of the reactor necessary for confirmation of its design capabilities and determination of its safe operation margins. The program of the physical startup included the reactor operation in three modes:

- mode of achieving critical mass;
- steady-state power mode in the range of 1-5000 W;
- pulsed mode with a pulse repetition rate of 5 Hz at a mean power of up to 100 kW.

Upon completion of the work under the program of the physical start-up the State Acceptance Commission confirmed the readiness of the reactor for the power start-up. The aim of the power start-up was to verify and specify the design margins and conditions of safe operation of individual units and the reactor as a whole at a power of up to 2 MW.

Within the framework of the program of the power start-up the following measurements were to be carried out:

- determination of absolute power level;
- measurement of thermal characteristics of the reactor;
- measurement of power pulse fluctuations and MR-3 vibrations;
- measurement of power and Na-flow reactivity effects;
- measurement of reactivity balance;
- investigation of characteristics of the safety control system (SCS);
- measurement of isothermal reactivity coefficient;
- measurement of power pulse shape;
- radiation monitoring in the technological and beam outlet areas

In 2011, the work to develop and construct a complex of cryogenic moderators was carried out in two main directions:

1. More than 30 cooling cycles with and without loading mesitylene beads to the simulation chamber were carried out on the test stand installed on channel 3 in the IBR-2 experimental hall. Using the results of these experiments:



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a) the technology of full loading of mesitylene beads to the simulation chamber for 3-5 hours has been developed;

b) hydrodynamical and thermophysical properties of the pneumatic conveying system have been studied, which is necessary for designing real units of pneumatic systems for transporting beads to the moderators;

c) the bead movement monitoring system on the basis of differential pressure diaphragm sensors has been developed;

d) the technical documentation necessary for installation of the cryogenic moderator on its regular place has been worked out.

2. Starting-up and adjustment works were continued on the refrigerator facility KGU-700/15.

### IREN FACILITY

During the first half of 2011 the experiments on the element and isotope analysis of space dust samples were carried out and the electronics for multichannel detectors of gamma-quanta for nuclear data experiments were developed.

Starting from July, 2011, the activities to put a new klystron Toshiba E3730A into operation have been in progress.