



## REVIEW OF TECHNOLOGICAL ELABORATIONS IN INNOVATION ACTIVITY IN INSTITUTE OF ATOMIC ENERGY

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One of the most important directions of IAE activity is works on safety substantiation of perspective reactors on fast neutrons with liquid metallic heat-transfer. Hard conditions of reactor and out-of pile experiments have required the elaboration of series of special measurement systems. Realized system parameters allow to use them not only in the experiments above, but in other industrial fields.

One of the basic controlled experiment parameters is short-time pressure impulse appeared under melt hitting of fuel composition into metallic heat-transfer. The original measurement system of pressure impulse in liquid sodium was elaborated. System operating conditions are as follows:

- influence of reactor gamma radiation;
- operating temperatures span 273 – 673 K;
- pressure measurement span 5 MPa and 20 MPa;
- transfer temperature in impulse 273 – 1500 K;
- sizes in power point are no more than Ø50 mm;

At the same time the system should provide pressure measurement error no high than 6 %.

Block of factors data did not allow using state or pressure impulse measurement systems offered at the market. During system elaboration a number of difficult technical problems were solved.

As the result the pressure impulse measurement system in liquid sodium for reactor experiments with models of reactor channels on fast neutrons with liquid metallic heat-transfer under temperature up to 400°C was elaborated. The system includes a pressure sensor, thermo protective device consisting of a membrane unit and impulse line with metallic extender with boiling temperature higher than 1000°C. The line length is up to 5 m.

A generator of pressure impulses for pressure impulse measurement system control was elaborated. The generator allows to form the regulated pressure impulse with amplitude up to 60 MPa and leading edge duration up to 5 ms. Impulse duration is from 20 to 100 ms. The operation results can be used during elaboration of fast operating pressure impulse measurement systems in high-temperature liquid mediums.

The pressure impulse generator is used as a prototype of gas-dynamic system of cleaning of oil and other types of pipelines.

For visual observation of process of fuel composition melt discharge the two-channel system of physical processes visualization under difficult optical conditions (steams of melt and water, dustiness, absence and sharp change of lightning and so on) was elaborated. It allows recording of almost nonaberrational video picture in apparent and infrared spans during long time with sufficiently high parameters (resolving capacity is 30 pc/mm, recording rate on apparent channel is up to 200 frames a second).

It was assumed to perform two variants of system – for reactor and out-of-pile experiments. The necessary test-constructive works were performed, however, now the system is realized and confirming high parameters only in out-of-pile variant because of insufficient financing.



To solve the problems of nondestructive control of significant experimental devices before and after the experiment and melt fragmentation inside their elements the digital roentgen nondestructive control system was elaborated and inculcated. The distinctive feature of system is an original introscope usage elaborated conjointly with Russian partners. Having sufficient low cost the device has high sensitive characteristics (1.6-2.0 %) and solving capacity (1 – 2 mm). in opinion of leading Russian specialists in the field of introscopy the device appreciably excels in parameters the existing analogs and is a significant progress in this field of techniques. Under the same radiator power the controlled steel thickness is increased on 30 mm and achieved 100 – 110 mm.

System characteristics allow the nondestructive control conducting in dynamic mode and it is especially important during control in the field conditions as pipelines mounting and also during the other problems solving required an operative dynamic material control and taking a decision in the real time mode.

Excepting technical usage the introscope can be effectively used in medicine allowing to modernize the existing film roentgen devices as well.



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## SPECTROMETRIC CONTROL OF RADIONUCLIDES PRODUCTION PARAMETERS

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A radioactive preparations and sources are widely used all over the world for scientific, industrial and medical purposes. These preparations in Belarus are planned to produce by the Joint Belarussian-Russian Closed Joint Stock Company "Isotope technologies" (CJSC IT). The company was created in 1998 by two leading scientific centers – SSI "Joint Institute of Power and Nuclear Research-Sosny" the National Academy of Sciences of Belarus and the State Center of Science of the Russian Federation "Scientific research institute of nuclear reactors".

One of the mainstream directions in CJSC IT activities is production of radioactive preparations for the industrial and scientific application (such as <sup>133</sup>Ba, <sup>109</sup>Cd, <sup>63</sup>Ni, <sup>60</sup>Co) and for the medical purposes (such as <sup>192</sup>Ir, <sup>60</sup>Co). All radioactive preparations have a good export potential and adequate to modern technical and consumer requirements. X-γ spectrometric analysis of considered radioactive sources is one of the basic methods for quality control of radioactive sources. At present, we are developing x-γ spectrometric support of purification process from contaminating radionuclides of <sup>109</sup>Cd -γ preparation and <sup>63</sup>Ni - β preparation. Work on x-γ spectrometric quality control of <sup>133</sup>Ba preparation is carried out.

The description of the used equipment is given. Techniques of contaminating radionuclides determination (contents ~ 10<sup>-6</sup> from activity of the basic radionuclide) are presented. Problems of the choice of geometry of measurements of sources with activity about 10<sup>7</sup>-10<sup>9</sup> Bq and possible sources of errors are discussed.