

RUSSIAN RERTR PROGRAM WORKS STATUS

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Abstract

The report presents the main results of works under the Russian

RERTR Program

carried out in the last year and plans for 1998.

Works under the Russian RERTR Program proceeded during the last year after the 19th International Meeting on RERTR held in Seoul.

It is known that the Russian Program stipulates three principle stages of the works.

Stage 1:

- development of fuel elements and fuel assemblies of VVR-M2, IRT and MR types (Fig. 1) with higher density fuel uranium dioxide.

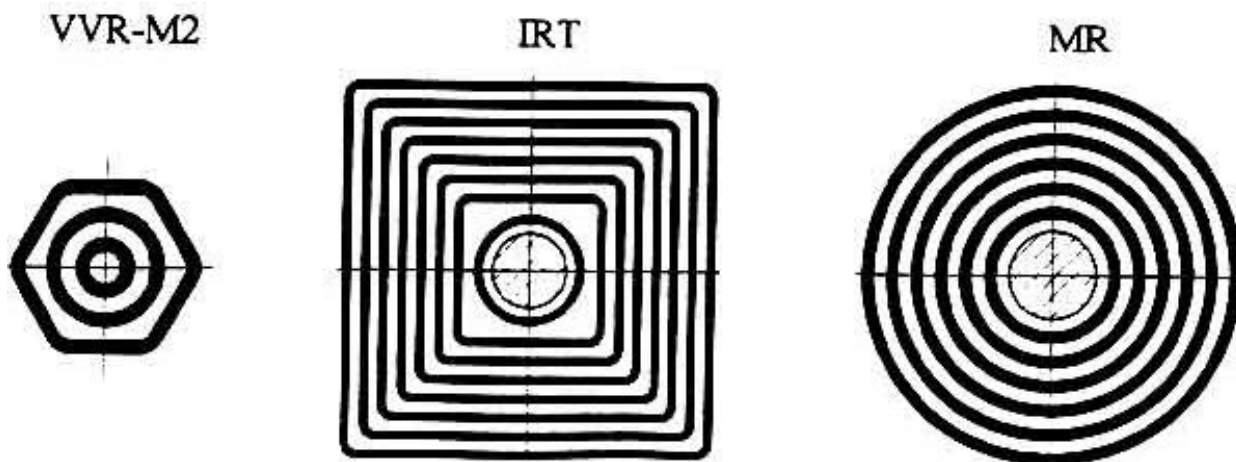


Fig. 1. Fuel Assembly Cross-Section

Stage 2:

-development of high-density fuel (U_3Si_2 , U_3Si , U_6Fe , UZr and others)

Stage 3:

-development of fuel elements and fuel assemblies of VVR-MS IRT and IVV-10 types (Fig. 2) with high-density fuel

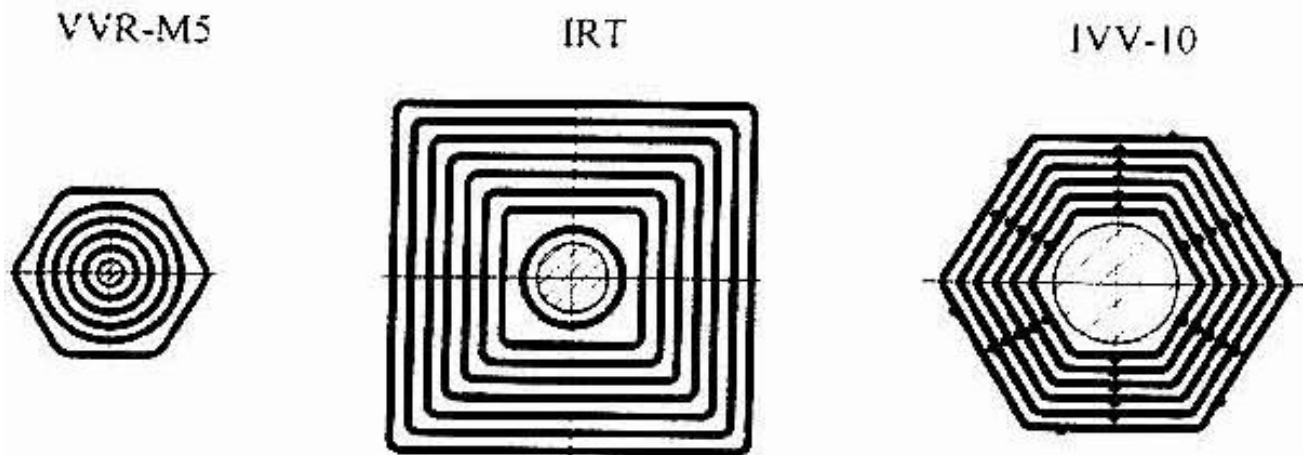


Fig. 2. Fuel Assembly Cross-Section

The Russian RERTR program supported by the US Argonne National Laboratory is under way. The first year contract signed with ANL is presently about to terminate and negotiations on the second year contract are in progress.

The Russian and American Parties have established a joint expert group which incorporates specialists from US Argonne National Laboratory and Russian enterprises participating in the RERTR Program. The expert group held two meetings - one in Moscow, the other in Jackson Hole (USA).

The expert group principle task is to discuss organizational matters related to signing and implementation of the contracts and also technical problems arising in the course of the Russian RERTR Program implementation.

Major works performed by Russian enterprises, during the last year are as follows:

Under the program Stage 1: development of FEs and FAs with uranium dioxide fuel, tests of combined FAs were going on: one FA of the IRT type (two FEs with fuel enriched to 19.7 % and 3.85 g/cm³ uranium dioxide density, the remaining FEs were standard with fuel of 90 % enrichment) in the IR-8 reactor at the Russian Research Center "Kurchatov Institute" and one FA of the MR type (with one FE of 19.7 % enriched fuel, the remaining FEs were standard with the 90 % enriched fuel) in the MIR reactor at the Research Institute of Atomic Reactors. Presently, fuel burnup in FE of the IRT type makes ~25 %, no FE failure indications were revealed. Tests of the MR-type combined FA were stopped due to some failure indication revealed. In this case, an average burnup made ~35 % in a fuel element under test. Which fuel element lost its leaktightness, whether it was a FE under test or a standard one, will be identified in further hot cell studies which we plan to perform in the nearest future.

Tests of 3 FAs of the IRT type were started in the IR-8 reactor at the RRC "Kurchatov Institute". All FEs in these tests were made of uranium dioxide fuel of 3.85 g/cm³ density and 19.7 % enrichment. However, all the three FAs lost their leaktightness right after the test were started up and were removed from the reactor. These FAs were subjected to visual inspection under a water layer in the reactor pool. This inspection did not manage to identify the failure causes. One of the FAs was subjected to FE-by-FE dismantling in a hot cell at the MR reactor. Visual inspection in a hot cell did not lead to identification of the failure cause. It is obvious that the failure cause will be possible to identify only after detailed studies in hot

cells. Testing statistics and further studies are needed to conclude that this fuel composition, proved to be good in the past, is capable to work or vice versa.

Testing of five FAs of the VVR-M2 type is presently started up in the VVR-M reactor at the St.-Petersburg Institute of Nuclear Physics wherein all FEs are of dioxide fuel of 2.5 g/cm³ uranium concentration and 19.7 % enrichment.

Testing of 3 FAs of the MR type are supposed to start in the MIR reactor at the Research Institute of Atomic Reactors in the nearest future. In these tests all FEs are of dioxide fuel with 3.85 g/cm³ uranium concentration and 19.7 % enrichment. A delay in startup of these tests is due to a need to identify causes for loss of leaktightness in the combined FA of the MR type mentioned above.

In spite of some failures as testing FEs and FAs with dioxide fuel we believe that the works related to dioxide fuel should proceed and as high as possible concentration of uranium dioxide in fuel be determined in order that FEs be in possession of high reliability and serviceability and also be of sufficient manufacturability.

Prior to installing the said FAs into the reactor there were developed test plans. According to these a decision is approved to justify an average design fuel burnup of 60 % in FE of an unloaded FA (as compared with 40 % in the existing ones) to enhance consumer's properties of the cores with such FAs; safety analysis for the tests was performed and specified on implementing physical measurements either on a critical test-rig or directly in a reactor at zero power.

Works on development of high density fuels as well as FEs and FAs based on them were carried out simultaneously with development of FEs and FAs with dioxide fuel of higher uranium concentration.

The Research Institute of Inorganic Materials keeps working on studying fuel gas swelling and estimation of alloying additions to stabilize fuel crystal structure; experimental devices with specimens

of compositions with higher density fuel are manufactured to test them in the IVV-2M reactor at the Sverdlovsk Branch of Research and Development Institute of Power Engineering. The test should start up in the nearest future.

Detailed presentations will be made by the Russian delegation participants on these and other works.

The following basic works are supposed to be performed under the Russian RERTR Program in the coming year:

- carry out the post-irradiation studies of leaking FAs;
- proceed testing FAs with dioxide fuel of higher uranium concentration;
- proceed working on development of high density fuel: test ampule devices with specimens of high density fuel, proceed laboratory studies with specimens and compositions of high density fuel and studying gas swelling, manufacture fuel granules for subsequent FE and FA manufacture;
- proceed neutronic and thermohydraulic calculations of the VVR-SM10 (Hungary), LVR-I5 (Czech) and MARIA (Poland) cores with 19.7 O/O enrichment for uranium-235