Methodology of Corrosion Testing of Nuclear and Fusion Reactors' Materals Using TGA/DSC and MS Complex Techniques

Yevgeniy Tulubayev[1], Vadim Bochkov[1], Mazhyn Skakov[1], Yevgeniy Chikhray[2], Yuriy Gordienko[1], Yuriy Ponkratov[1], Timur Kulsartov[1], Zhanna Zaurbekova[1], Kuanysh Samarkhanov[1], Saulet Askerbekov[2]

[1] *Branch Institute of Atomic Energy, NNC RK, 10 Krasnoarmeyskaya st., Kurchatov, 071100, Kazakhstan*
[2] *IETP al-Farabi KazNU, 96a Tole bi st., Almaty, 050012, Kazakhstan*

E-mail: *bochkovv@nnc.kz*

Nowadays, nuclear power is the best that humanity has for the production and supply for cheap electric and thermal energy. The development of nuclear power takes place in a rigid competitive struggle, both with the traditional technologies of electricity production, and with alternative (renewable) sources.

The key issues of such competition in 21st century are security and economy. Precisely, the behavior of structural materials on operating and designed fission and fusion reactors largely determines their safe and economical work. The role of structural materials in fission and fusion reactors consists not only in ensuring stability for the whole period of core geometry operation, and foremost, in a fuel assemblies (FA) and in a fuel elements. Also it consists in the retention of fission products within the fuel element, maintaining of control and safety system and ensure the minimum consequences of possible emergencies.

Since structural materials in fission and fusion reactors are operated in different conditions and temperature ranges, they are subject to high requirements. This paper presents the methodology of complex studies of corrosion resistance of structural materials of nuclear and fusion reactors with different gases and vapor-gas mixtures by TGA, DSC and mass spectrometry methods simultaneously. The analysis of research methods on corrosion properties of structural materials is carried out, the optimal schematic diagram of the experiment was determined and a block diagram of the processes of this interaction was developed.

As a result of this work, a special experimental test-bench was created and adjustment works were carried out for the study of corrosion resistance of structural materials in fission and fusion reactors with various gases and vapor-gas mixtures.