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DEVELOPMENT OF ITER PROJECT ACTIVITY IN THE REPUBLIC OF KAZAKHSTAN

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For the present moment the austenite steels, vanadium alloys, copper alloys, graphite, molybdenum, tungsten and beryllium are considered to be prospective materials for bearing structure, plasma facing components and neutron multiplier of fusion reactors. Investigations, being carrying out within the frameworks of ITER project in Republic of Kazakhstan, were oriented onto the study of hydrogen isotope behavior in the components of the first wall and divertor in the conditions, approximately simulating the real conditions of materials operation and as well as in the emergency situation of water steam interaction with the beryllium armor of the first wall in the case of coolant loss accidents. The main goal of the works – substantiation of ITER reactor safety.

The works on ITER project in Kazakhstan are being carried out pursuant to the following main directions, main part of which is the continuation of the works, stated in [1].

- Investigation of physical and mechanical properties of beryllium samples, irradiated in BN-350 reactor up to high destructive doses (MAEK).
- Development of technology of diffusion welding and brazing of beryllium with copper and copper with stainless steel; manufacturing of Be/Cu mock-ups (JSC «UMZ»).
- Testing of technology and manufacturing of black body mock-ups for the experiments on measurement of beryllium surface blackness degree in various accidents.
- Investigation of mock-ups of the first wall armor, facing to plasma, in the water steam atmosphere to verify computer codes of loss of coolant accident modeling in ITER reactor (Atomic Energy Institute NNC RK). [2]
- Investigation of beryllium emissivity and transition processes on the overheated surface as well as the oxidation level of beryllium surface (Atomic Energy Institute NNC RK).
- Investigation of the parameters of equilibrium and non-equilibrium hydrogen interaction with beryllium and vanadium alloy at the controlled variation of surface element composition using Auger electron spectroscopy technique (NIETF Kazakh State University). [3]

- Investigations of gas release from the RG-T graphite samples irradiated in the atmosphere of hydrogen in IVG.1M reactor (NIETF Kazakh State University, Atomic Energy Institute NNC RK) [4].
- Investigation of hydrogen isotopes retention and release from the beryllium samples of various grades (EHP-56, HIP-56, HP-56), irradiated in hydrogen and deuterium atmosphere in IVG.1M and RA reactors (NIETF Kazakh State University, Atomic Energy Institute NNC RK) [5]. This activity was partly supported by IAEA contract.
- Investigation of hydrogen permeation of V-Cr4-Ti4 vanadium alloy, in-pile and out-pile experiments, including the experiments with protective coatings (NIETF Kazakh State University, Atomic Energy Institute and Nuclear Physics Institute NNC RK).
- Investigation of hydrogen isotopes interaction with Be/Cu duplex structure and resputtered beryllium layers (NIETF Kazakh State University, Atomic Energy Institute and Nuclear Physics Institute NNC RK). This activity was supported by the ISTC, K-40 Project.

Intended directions of investigations.

1. Carrying out the in-pile experiments to study the permeation of tritium, generated from lithium-lead eutectic, through structural materials (low activated steels) with barrier layers applicable to DEMO reactor (Supported by the ISTC, K-39 Project).
2. Development of nuclear physical diagnostics of ion fraction of fusion plasma and substantiation of high-flux reactors use for its examination (Supported by the ISTC, K-39 Project).
3. Carrying out the in-pile thermal physical experiments with beryllium pebbles for projected breeder blanket.

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