**STCU project proposal # 5243 on “Interaction Studies of Improved VVER Structural Materials at Severe Accident Conditions"**

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The operation of water-moderated reactors (VVER) does not exclude a possibility of beyond design-basis accidents with a core materials meltdown.

Currently, activities are underway to extend the operation life and reliability of reactor cores through application of new materials and structural improvements. Knowledge of how the use of new materials and structures will affect core melt formation during beyond design-basis accidents is a sine qua non of activities to increase NPP safety in general.

To identify solutions for the issues followed by core melt formation in VVER type reactors “Nuclear Fuel Cycle” Science and Technology Establishment of National Science Center “Kharkov Institute of Physics and Technology” (NFC STE NSC KIPT) propose to carry out scientific and material testing research within the frame of the STCU Project Proposal #5243: «Interaction Studies of Improved VVER Structural Materials at Severe Accident Conditions».

The project is designed to:

- obtain data on interaction parameters of the materials in VVER improved core structural components;

- obtain data on melt formation, first and foremost of fuel and neutron absorbers with the structural materials;

- identify phase composition of the resulting melts in the solid state;

- determine physical characteristics of viscosity and fluidity of melts from materials used in standard and upgraded designs of VVER components.

The main tasks of the project proposal are:

based on the analysis of the data available in the literature to identify a probable scenario for heavy accident development at NPP;

upgrade and prepare process equipment and instrumentation for carrying out research;

upgrade design and manufacturing of sample fuel and absorber rods for research;

upgrade methodologies to conduct experiments and study the structure and composition of power reactor core materials before and after their interaction (in the solid state and after melting);

study the effects of fuel and absorber rod structural features (close contact, presence of oxides on the surface) on the nature of the beginning of their materials' interaction; obtain data on the temperature parameters of the beginning of melt formation as a function of material state;

obtain melts of standard VVER fuel and absorber rods, namely combination of UO2 + Gd2O3 materials with the alloy Zr1%Nb (E110) and stainless steel with boron carbide;

study processes of melt formation for new combinations of absorber materials B4C, Dy2O3•TiO2, Hf and interaction of these components with the melt of fuel materials;

identify phase composition of melts thus formed;

identify melt viscosity and fluidity parameters depending on their phase composition.

The obtained melt parameters will allow to predict accident processes and carry out more detailed experiments on interaction of melts with the consumable material of traps to predict their crippling.