

CORPHAD and METCOR ISTC projects

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SUMMARY

The International Science and Technology Center (ISTC) currently manages about 40 nuclear projects in the framework of the Science Project Program.

The ongoing CORPHAD Project (Phase Diagrams for Multicomponent Systems Containing Corium and Products of its Interaction with NPP Materials) was started in August 2001. The main aim of the project is to experimentally determine the relevant experimental data on phase diagrams of binary, ternary, quaternary and prototypic multi-component systems, which are important for analysis and modelling of a severe accident (SA) and efficient planning of severe accident management (SAM) measures. The data should be directly used for the European NUCLEA database development and validation. The following systems are in the focus of the project: (1) $UO_2 - FeO$, (2) $ZrO_2 - FeO$, (3) $SiO_2 - Fe_2O_3$, (4) $UO_2 - SiO_2$, (5) $UO_2 - ZrO_2 - FeO$, (6) $UO_2 - ZrO_2 - FeO_y$, (7) U-O-Fe, (8) Zr-O-Fe, (9) U-O-Zr, (10) U-Zr-Fe-O, (11) complex corium mixtures.

The experimentally determined data of the listed diagrams include: coordinates of characteristic points (eutectics, peritectics and others); liquidus and solidus concentration curves; component solubility limits in the solid phase; tie line coordinates and temperature-concentration regions of the miscibility gap. Different methodologies are used for the diagram study. Classical methods of thermal analysis, like DTA and DSC are combined with methods specifically developed for corium studies.

The METCOR project (Investigation of Corium Melt Interaction with NPP Reactor Vessel Steel) started in April 1999. The objectives of the project are to qualify and to quantify physico-chemical phenomena of corium melt interaction with reactor vessel steel cooled from the outside. The variable parameters of the interaction tests are: oxygen potential in the system, corium composition, interaction interface temperature and heat flux from corium to steel. The medium scale tests with corium mass of about 2 kg are carried out by using high frequency induction heating of the corium melt in a cold crucible.

The METCOR&CORPHAD work-packages are performed by Russian partners in close collaboration with leading European scientific institutes in the area of corium research as well as with the European nuclear industry.

This paper briefly describes the first results obtained in both projects and their possible application for SA analysis and SAM. The paper concludes with recommendations for future research activities in the frame of METCOR and CORPHAD projects.