Summary

Progress report on the ISTC project #3813 “Phase relations in corium systems” (PRECOS)

Specific subject of the project is the experimental investigation of phase diagrams of oxidic and metal-oxide corium systems which are formed as the result of core meltdown and interactions of melt with structural materials of the reactor, concrete shaft and core catcher.

The following systems will be studied in PRECOS:

- Binary and ternary oxidic systems (CaO-UO2, CaO-FeO, SiO2-UO2, UO2-FeO-SiO2, UO2-FeO-CaO, ZrO2-FeO-SiO2, ZrO2-FeO-CaO) containing components of concretes and sacrificial materials, i.e. of importance for modeling the interaction of corium with materials of the concrete shaft and core catcher at the ex-vessel stage of a severe accident development. The SiO2–containing systems should be specially mentioned, as their high viscosity and low conductivity make their experimental investigation problematic. Still, they are very important for modeling the ex-vessel corium from a series of power reactors, including such modern ones as EPR.

- Metal-oxidic systems U-Zr-Fe-O with different concentrations of components, especially in the miscibility gap.

- Multicomponent mixtures representing prototypic ex-vessel corium.

The main results of the project will be the following experimentally determined data:

* Tliq and Tsol concentration dependencies;
* Coordinates of characteristic points, such as eutectic, dystectic, etc.;
* Limits of components solubility in the solid phase;
* Compositions of the liquids coexisting in the miscibility gap.

Experimental methods to be applied for phase diagram study are:

- Visual polythermal analysis in the cold crucible (VPA IMCC)

- Differential thermal analysis (DTA) and differential scanning calorimetry (DSC)

- Visual polythermal analysis in the Galakhov microfurnace (GM)

- High-temperature microscopy (HTM)

- Laser pulse heating (LP) – New method

The project started from June 1, 2008. Study of SiO2-UO2, UO2-CaO binary oxidic system has been completed.  Study of other systems is in progress. The 4th project meeting was held on 8 June 2011 in St.Petersburg. Multicomponent corium compositions for Task 4 implementation were discussed at the meeting. The progress report deals with experimental results on ternary oxidic systems:

- UO2-FeO-CaO

- UO2-FeO-SiO2