# ANNEX I

# Work Plan

## I. Summary Project Information

### 1. Project Title

Phase relations in corium systems

### 2. Project Manager

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
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### 3. Participating Institutions

#### 3.1. Leading Institution

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Short reference:** | | | | | NITI | | | | | | |
| **Full name:** | | | A.P. Alexandrov Research Institute of Technology (NITI) | | | | | | | | |
| **Street address:** | | | | NITI | | | | | | | |
| **City:** | Sosnovy Bor | | | | | | | **Region:** | | Leningrad | |
| **ZIP:** | 188540 | | | | | | | **Country:** | | | Russia |
| **Name of Signature Authority:** | | | | | | | Vasilenko Vyacheslav Andreyevich | | | | |
| **Title:** | Dr.Sci. (Engineering) | | | | | | | **Position:** | | General director | |
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| **E-mail:** | | foton@niti.ru | | | | | | | | | |
| **Governmental Agency:** | | | | | | Federal Atomic Energy Agency | | | | | |

#### 3.2. Other Participating Institutions

#### Participant Institution 1

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Short reference:** | | | | | ITES OIVT RAS | | | | | | |
| **Full name:** | | | Institute of Thermophysics in Extreme Conditions of the Amalgamated Institute of High Temperatures of RAS | | | | | | | | |
| **Street address:** | | | | 13/19, Izhorskaya Str. | | | | | | | |
| **City:** | Moscow | | | | | | | **Region:** | |  | |
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| **Name of Signature Authority:** | | | | | | | Zeygarnik Vladimir Albertovich | | | | |
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| **Governmental Agency:** | | | | | | Russian Academy of Sciences | | | | | |
| **Sub-manager:** | | | | Sheindlin Mikhail Alexandrovich | | | | | | | |
| **Title:** | Dr. Sci. (Phys.-Math.) | | | | | | | **Position:** | | Head of department | |
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### 4. Foreign Collaborators/Partners

#### 4.1. Collaborators

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Institution:** | | | | Forschungszentrum Karlsruhe GmbH (FZK) | | | | | | |
| **Street address:** | | | | | P.O. Box 3640 | | | | | |
| **City:** | Karlsruhe | | | | | **Region/State:** | | | |  |
| **ZIP:** | 76021 | | | | | **Country:** | | | Germany | |
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| **Institution:** | | | | Forschungszentrum Karlsruhe GmbH (FZK) | | | | | | |
| **Street address:** | | | | | P.O. Box 3640 | | | | | |
| **City:** | Karlsruhe | | | | | **Region/State:** | | | |  |
| **ZIP:** | 76021 | | | | | **Country:** | | | Germany | |
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| **Institution:** | | | | EUROPAISCHE KOMISSION, Institut fur Transurane (JRC ITU) | | | | | | |
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| **Institution:** | | | | AREVA NP GmbH, NEPR-G | | | | | | |
| **Street address:** | | | | | Freyeslebenstr. 1 | | | | | |
| **City:** | Erlangen | | | | | **Region/State:** | | | |  |
| **ZIP:** | 91058 | | | | | **Country:** | | | Germany | |
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| **Institution:** | | | | AREVA NP GmbH, NTR-G | | | | | | |
| **Street address:** | | | | | Freyeslebenstr. 1 | | | | | |
| **City:** | Erlangen | | | | | **Region/State:** | | | |  |
| **ZIP:** | 91058 | | | | | **Country:** | | | Germany | |
| **Person:** | | | Sieghard Hellmann | | | | | | | |
| **Title:** | | Doctor | | | | **Position:** | | Senior Scientist | | |
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| **Institution:** | | | | CEA Grenoble - DTA/CEREM/DEM/SPCM | | | | | | |
| **Street address:** | | | | | 17 Rue des Martyrs | | | | | |
| **City:** | Grenoble CEDEX 9 | | | | | **Region/State:** | | | |  |
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| **Institution:** | | | | IRSN/DRS/SEMAR/CEN Cadarache | | | | | | |
| **Street address:** | | | | | B.P. 3, Bat. 702 | | | | | |
| **City:** | St Paul lez Durance | | | | | **Region/State:** | | | |  |
| **ZIP:** | F-13115 | | | | | **Country:** | | | France | |
| **Person:** | | | Marc Barrachin | | | | | | | |
| **Title:** | | Doctor | | | | **Position:** | | Senior Scientist | | |
| **Tel.:** | +33 4 42 19 94 14 | | | | | **Fax:** | + 33 4 42 19 91 66 | | | |
| **E-mail:** | | | marc.barrachin@irsn.fr | | | | | | | |

#### 4.2. Partners

No

### 5. Project Duration

36 months

### 6. Project Location and Equipment

|  |  |
| --- | --- |
| **Institution** | **Location, Facilities and Equipment** |
| **Leading Institution** | Address of equipment location:  Bldg 12 (assembling hall), Bldg 11 (rooms 405,404) of LSK «Radon» in Sosnovy Bor, 188540 Leningrad Region, Russia.  Equipment:  RASPLAV-2, RASPLAV-3 and RASPLAV-4 experimental facilities employing the method of induction melting in the cold crucible (IMCC) for producing molten prototypic corium heated up to 3300 C in a neutral or oxidizing atmosphere (HF generator, induction furnaces, safety and auxiliary technological systems). The RASPLAV-2 facility is employed for the tests with the oxidized and suboxidized oxidic systems; RASPLAV-3 is used for the tests with metal-oxidic systems, while RASPLAV-4 has been designed for the tests with silica-containing systems. DAS that comprises detectors and sensors for measuring electric parameters of the generator, flow-rate, temperature, etc. Instruments and facilities for physicochemical analyses (mass-spectrometer, X-ray diffractometers and spectrometers, Galakhov microfurnace, chromatograph, etc.). SETARAM thermoanalyzer for the differential thermal analysis, calorimetry and thermogravimetry. Computers and office equipment. |
| **Participant Institution 1** | Address of equipment location:  13/19, Izhorskaya Str., Bldg. 1B-3b, Rooms 3-4, 3-13, 3-14, 127412 Moscow, Russia.  Equipment:  The studied specimens are molten using a powerful CW ytterbium fiber laser with time programmed power and other lasers, e.g., LTN-103, LK-200-OV and YLR-1500. The specimen surface is monitored using high-speed video recording. The analyses of microstructure and elemental composition of the initial and tested specimens are made using the Hitachi S405A scanning electron microscope, Stereoscan S4-10 scanning electron microscope and Cameca SX100 X-ray microanalyzer. The X-ray diffractometry is carried out using DRON-3, DRON-2 and DRON-0.5 X-ray diffractometers.  Multiwave pyrometry. Computers and office equipment. |

## II. Specific information

### 1. Introduction and Overview

The modern practice of reactor unit safety analysis in case of a severe accident employs the coupled thermo-hydraulic and thermodynamic modeling of the high-temperature phenomena, which accompany the accident progression. Thermodynamic modeling of multicomponent melts applies specialized numerical codes (e.g., GEMINI-2) and program-specific databases (e.g., NUCLEA-06). The databases incorporate available experimental data, which are not sufficient for reliable reactor application.

The project is aimed at experimental studying phase diagrams of oxidic and metal-oxidic systems, which should be available for the NPP severe accident analysis and management.

A significant number of investigations was devoted to experimental studies of corium phase diagrams. Among the recent ones are such EU projects as ECOSTAR, COLOSS, ENTHALPY, CIT and SARNET (the proposed project staff participated in the three mentioned), as well as the ISTC project # 1950.2 CORPHAD. The latter was carried out by the team of the current project.

The new members of the research team from ITES OIVT RAS also have had an experience of the phase diagram studies, for which they used the original laser pulse method and a facility employing it. They also produced new experimental data on phase diagrams.

The new data were used to optimize the European NUCLEA database and increase accuracy of thermodynamic modeling of core melt behaviour in severe accident conditions. Main results of completed studies have been published in the following journal and conference papers:

1. Lopukh D., Bechta S., Pechenkov A., Vitol S., Hellmann S., Fischer M., Froment K., Duret B., Seiler J. New Experimental Results on the Interaction of Molten Corium with Core Catcher Material // 8th International Conference on Nuclear Engineering, ICONE-8179, April 2-6, 2000, Baltimore, MD, USA.
2. Mezentseva L.P., Popova V.F., Almjashev V.I., Lomanova N.A., Ugolkov V.L., Bechta S.V., Khabensky V.B., Gusarov V.V. Phase and chemical transformations in the SiO2-Fe2O3(Fe3O4) system at different partial pressure of oxygen // J. of Inorganic Chemistry, 2006, V. 51, No. 1, p. 1-8.
3. Bechta S.V., Krushinov E.V., Almjashev V.I., Vitol S.A., L.P., Petrov Yu.B., Lopukh D.B., Khabensky V.B., Barrachin M., Hellmann S., Gusarov V.V. Phase relations in the ZrO2-FeO system// J. of Inorganic Chemistry, 2006, V. 51, No. 2, p. 367-374.
4. Bechta S.V., Krushinov E.V., Almjashev V.I., Vitol S.A., Mezentseva L.P., Petrov Yu.B., Lopukh D.B., Khabensky V.B., Barrachin M., Hellmann S., Froment K., Fischer M., Tromm W., Bottomley D., Defoort F., Gusarov V.V., Phase diagram of the ZrO2-FeO system // J. Nucl. Mater., 348 (2006), 114-121.
5. Mezentseva L.P., Popova V.F., Almjashev V.I., Lomanova N.A., Ugolkov V.L., Bechta S.V., Khabensky V.B., Barrachin M., Hellmann S., Gusarov V.V., Phase diagrams of the SiO2-Fe2O3(Fe3O4) systems in different gas atmosphere // J. Europ. Ceram. Soc., 2006, in press.
6. Bechta S.V., Khabensky V.B., Granovsky V.S., Krushinov E.V., Vitol S.A., Gusarov V.V., Almjashev V.I., Mezentseva L.P., Petrov Yu.B., Lopukh D.B., Fischer M., Bottomley D., Tromm W., Barrachin M., Altstadt E., Piluso P., Fichot F., Hellmann S., Defoort F., CORPHAD and METCOR ISTC projects // The first European Review Meeting on Severe Accident Research (ERMSAR-2005), Aix-en-Provence, France, 14-16 November, 2005.
7. Bechta S.V., Krushinov E.V., Almjashev V.I., Vitol S.A., Mezentseva L.P., Lopukh D.B., Petrov Yu.B., Khabensky V.B., Barrachin M., Hellmann S., Froment K., Fischer M., Tromm W., Bottomley D., Defoort F., Gusarov V.V., Phase diagram of the UO2-FeO1+x system // J. Nucl. Mater., 362 (2007) 46-52
8. Manara D., Sheindlin M. and Levis M. Advances in Measurements of the Melting Transition in Non-Stoichiometric UO2 // Int. J. of Thermophysics, vol. 25, ? 2 (2004), p. 533-545.
9. Manara D., Pflieger R. and Sheindlin M. Advances in the Experimental Determination of the Uranium – Oxygen Phase Diagram at High Temperature // Int. J. of Thermophysics, vol. 20, ? 4, July 2005, p. 1193-1206.
10. Pflieger R., Sheindlin M. And Colle J.-Y., Thermodynamics of Refractory Nuclear Materials Studied by Mass Spectrometry of Laser-Produced Vapors // Int. J. of Thermophysics, vol. 26, ? 4, July 2005, p. 1075-1093.

Still, a large number of insufficiently studied systems, effort-intensive and complex experiments and post-experimental studies of high-temperature melts, as well as the limited timeframe of the ISTC CORPHAD project restricted the investigation of phase diagrams belonging to relevant, but insufficiently studied systems.

Therefore, in spite of completed studies there is a deficit of experimental data on phase diagrams, it especially refers to the systems with low oxygen potential and to those containing components of concretes.

The PRECOS data will cut the deficit of experimental data on phase diagrams of oxidic systems, which are important for reactor application, but have not been sufficiently studied.

Such insufficiently studied systems are:

- 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, which are formed at the interaction of the melt with reactor pit and core catcher at an ex-vessel stage of the severe accident progression. The SiO2–containing systems should be mentioned separately: their high viscosity and low electric conductivity is a challenge for experimental investigation, and they produce a strong influence on melt properties.

- Metal-oxidic systems with different concentration of components, especially in the miscibility gap.

- Multicomponent mixtures representing prototypic corium.

The PRECOS experimental matrix, which has been developed jointly by project participants and collaborators and approved at the 11th SEG-SAM, is given in the table below.

Experimental matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Task** | **Composition** | **Atmosphere** | **Test objective** | **Method of determination** | **Priority** | **Points number** |
| 1 | Individual compositions in the U-Zr-Fe-O system | Argon | Tliq, Tsol, tie-lines in the miscibility gap | VPA IMCC1), DTA2), HTM3), Galakhov microfurnace, PLH4) | 1 | 6 |
| 2 | ZrO2-FeOy | Air and mixtures with controlled partial pressure of Î2 | Tliq, Tsol, solubility limits |  | 2 | 3 |
|  | UO2-SiO2 |  | Tliq, Tsol, solubility limits, eutectic point, tie-lines in the miscibility gap | VPA IMCC, DTA, HTM, Galakhov microfurnace | 1 | 7 |
|  | CaO-UO2 |  | Tliq, Tsol, solubility limits |  | 1 | 7 |
| 3 | UO2-FeO-SiO2 | Argon | Tliq, Tsol, solubility limits, tie-lines in the miscibility gap, ternary eutectic point |  | 1 | 10 |
|  | UO2-FeO-CaO |  | Tliq, Tsol, solubility limits |  | 1 | 10 |
|  | ZrO2-FeO-SiO2 |  | Eutectic point | Equilibrium crystallization during IMCC,  SEM/EDX of the eutectics | 2 | 2 |
|  | ZrO2-FeO-CaO |  |  |  | 2 | 2 |
| 4 | Multicomponent prototypic corium | Argon or air | Tliq | VPA IMCC | 2 | 3 |

1) Induction melting in the cold crucible with visual polythermal analysis

2) Differential thermal analysis

3) High-temperature microscopy

4) Pulsed laser heating

### 2. Expected Results and Their Application

The Project belongs to the fundamental research category. The main results of the project shall include the following experimentally determined characteristics:

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

The project outputs will be used for:

1. database updating by the previously absent or specified experimental information on phase diagrams of the oxidic and metal-oxidic corium systems;
2. refining thermodynamic models, including miscibility gaps and quasiequilibrium states in the thermal gradient conditions;
3. verification of thermodynamical codes that model phase diagrams of multicomponent systems, which result from the interaction between the core melt with structural and construction materials of the reactor, concrete pit and core catcher;
4. safety analysis and safety enhancement for currently operating and developed NPPs.

2.1. Sustainability Implementation Plan

2.1.1. Commercialized results

None

2.1.2. Novelty of project results

The project will provide the still missing experimental data on phase diagrams of systems important for reactor application.

2.1.3. Potential demand on project outputs

The project results can be of interest to the institutes, research and design companies, which develop NPP projects and safeguard their safety, as well as to the research organizations working in the field of physical chemistry and material studies.

2.1.4. Expected revenues

Not expected

2.1.5. Intellectual property rights

Regulated by the RF legislation and standard agreement with the ISTC

2.1.6. Additional development

Not required

2.1.7. Plan of implementation

Experimental and methodological base for the investigations with high-temperature uranium-bearing melts.

2.1.8. Additional licenses or permits

Not required

2.1.9. Business network

Not planned

### 3. Meeting ISTC Goals and Objectives

The project will be implemented within 36 months by 55 participants, of which 28 persons have been previously involved in the weapons development.

The work will be implemented by the Leading Institution – the A.P. Alexandrov Research Institute of Technology (NITI) of the Russian Atomic Energy Agency, and by the Participant Institution 1 – Institute of Thermophysics in Extreme Conditions of the Amalgamated Institute of High Temperatures of RAS (ITES OIVT RAS).

The current project will:

1. allow the specialists, previously involved in weapons development, to redirect their skills to peaceful activities;
2. support applied research performed for peaceful purposes, especially in the fields of environment protection, power production and nuclear safety;
3. promote the integration of Russian scientists into the international scientific community and maintain the scientific potential of Russia;
4. reinforce the transition to the market-based economy responsive to civil needs.

Thus, the project meets the ISTC goals and objectives completely.

### 4. Scope of Activities

The Project is planned for the period of 3 years.

The total funding is 975 522.61 USD.

The tasks set by the proposed project shall be solved by making tests presented in the experimental matrix.

The test succession priority, experimental methodology and specifications, compositions and temperature-concentration domains of the studied systems, as well as the number of experimental points for each system will be discussed and coordinated with collaborators before each test.

According to the experimental matrix 4 tasks should be implemented.

The objective of all 4 tasks is to obtain the missing experimental data on the metal-oxidic systems of the in-vessel corium and oxidic systems of the ex-vessel corium.

Task 1 - Investigation of individual compositions of the metal-oxydic system

Task 2 - Investigation of binary oxidic systems.

Task 3 - Investigation of ternary oxidic systems

Task 4 - Determination of liquidus temperature of a multicomponent prototypic corium composition.

Each task includes the following stages: test preparation and performance, primary analysis of the findings, physicochemical analysis, pre- and posttest calculations, and the analysis of results.

#### Task 1

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| Investigation of various compositions of the metal-oxidic system aimed at determining Tliq, Tsol and tie-lines in the miscibility gap.  Main stages:  1.1. State of the art review.  1.2. Tests preparation, performance and primary analysis of the data.  1.3. Posttest physicochemical analysis of samples.  1.4. Pre- and posttest calculations using thermodynamical codes.  Integrated analysis and generalization of the experimental data. | | 1-NITI  2-ITES OIVT RAS |
| **Description of deliverables** | | |
| 1 | A report on the study results. | |
| 2 | The Task 1 results will be discussed in detail at a joint seminar of collaborators and contractors | |

#### Task 2

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| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| Study of binary oxidic systems.  Main stages:  2.1. State of the art review.  2.2. Tests preparation, performance and primary analysis of the data.  2.3. Physicochemical posttest analysis of samples.  2.4. Pre- and posttest calculations using thermodynamical codes.  Integrated analysis and generalization of the experimental data. | | 1-NITI |
| **Description of deliverables** | | |
| 1 | Progress reports on the results of individual systems studies. | |
| 2 | A report on the results of studying binary oxidic systems. | |
| 3 | Minutes of a meeting with collaborators. | |

#### Task 3

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| Study of ternary oxidic systems  Main stages:  3.1. State of the art review.  3.2. Tests preparation, performance and primary analysis of the data.  3.3. Physicochemical posttest analysis of samples.  3.4. Pre- and posttest calculations using thermodynamical codes.  Integrated analysis and generalization of the experimental data.. | | 1-NITI |
| **Description of deliverables** | | |
| 1 | Progress reports on the results of individual systems studies | |
| 2 | A report on the studies of ternary oxidic systems. | |

#### Task 4

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| Determination of Tliq for a prototypic multicomponent composition.  Main stages:  4.1. Pretest numerical modeling of a multicomponent prototypic system.  4.2. Tests preparation, performance and Tliq determination.  4.3. Physicochemical posttest analysis of samples.  4.4. Posttest calculations using thermodynamical codes.  4.5. Integrated analysis and generalization of experimental data.  4.6. Comparison of numerical and experimental data. Assessment of modeling accuracy | | 1-NITI |
| **Description of deliverables** | | |
| 1 | A report on the results of the multicomponent system studies. | |
| 2 | Minutes of a meeting with collaborators. | |

Compositions of the studied systems are specified in interaction with collaborators

Pre- and posttest thermodynamical calculations are to be made simultaneously by collaborators and developers of the GEMINI2 program.

A decision about the next test or an update of the experimental matrix shall be made after the preceding test has been discussed with collaborators.

The number of tests (phase diagram experimental points) should total ~ 50.

In the end of each quarter, a progress report on the period shall be submitted. Completion of each task and each year of the project shall be formalized by a report including the analysis of outputs produced during the whole reported period. On completion of all tasks, the final project report shall be issued and finalized on recommendations of collaborators or the ISTC.

Diagram of cooperation between the tasks is given below.

Cooperation between Tasks 1-4

Experimental matrix

Task 1

Task 2

Task 3

Task 4

### 5. Role of Foreign Collaborators/Partners

The Project envisages the following cooperative activities with foreign collaborators:

1. joint development of experimental matrix and its updates in the course of Project implementation;
2. efficient information exchange during Project implementation ;
3. discussion of scientific and technical reports (progress, annual, final) with the aim of modifying experimental methodology, considering the proposed specifications of the physicochemical interaction models;
4. cross-checks of project findings by pre- and posttest calculations using the GEMINI2 thermodynamic code, and, if necessary, twin tests at ITU in Karlsruhe;
5. joint meetings and seminars;
6. shared presentations and papers.

### 6. Technical Approach and Methodology

The experimental research in the framework of the CORPHAD project is carried out on the RASPLAV-2, RASPLAV-3 and RASPLAV-4 experimental facilities, which permit handling of molten prototypic corium heated up to 3300 K. The RASPLAV-2 facility is used for tests with oxidized and suboxidized oxidic systems, RASPLAV-3 - for the tests with metal-oxidic systems, and RASPLAV-4 - for the tests with silica. Molten corium is produced using the method of induction melting in a cold crucible (IMCC). The method is suitable for the phase diagram investigations (for some systems it is the only method possible), as the presence of the solid phase (crust) between the melt and cold crucible prevents the crucible-melt mass transfer, ensures melt retention in the crucible and high purity of the melt (close to the initial components’ purity.) The IMCC method provides contact-free power input into the melt and its internal deposition. The RASPLAV-2 and RASPLAV -3 facilities can produce, respectively, up to 8 an 2 kg of high-temperature molten corium in a neutral above-melt atmosphere, air or steam.

Some experimental studies also use such facilities as the Galakhov microfurnace, high-temperature microscope, derivatographs, and the high-temperature differential thermoanalyzer available in the Institute of Silicate Chemistry of the Russian Academy of Sciences (ISC RAS). These facilities make it possible to investigate phase diagrams up to 2800 K and get experimental data having a high accuracy and reliability.

Additionally to the methods used in the ISTC #1950.2 CORPHAD2 project, the high-temperature behavior of the metal-oxidic system will be studied using a method based on the laser-induced heating, which was developed by another project participant ITES OIVT RAS. This method has been previously used for studying superstoichiometric urania (Manara & Sheindlin) and suboxidized systems (Bottomley & Sheindlin). The range of its application will be increased for determining Tsol and Tliq by additional high-speed video recording of the specimen surface.

Therefore, the methods used in phase diagram studies are as follows:

• 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 of the specimen (LPH)

These methods have been tried in the COLOSS, METCOR, CIRMAT, CIT, ENTHALPY, ECOSTAR and OECD/MASCA projects.

The physicochemical analysis employs the following methods:

1. Elemental composition analysis

• X-ray fluorescence analysis (XRF)

• Chemical analysis (ÑhA)

• Oxygen determination using the method of carbothermal reduction of specimens

2. Phase composition analysis

• X-ray diffraction analysis (XRD)

• Energy-dispersive X-ray spectrometry (EDX)

3. Metallography and ceramography (Opt M)

• Optical microscopy

• Scanning electron microscopy (SEM)

For the Project implementation the experimental facilities will be modernized and the methods of physicochemical analysis improved.

### 7. Technical Schedule

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Quarter 1** | **Quarter 2** | **Quarter 3** | **Quarter 4** | **Quarter 5** | **Quarter 6** | **Quarter 7** | **Quarter 8** | **Quarter 9** | **Quarter 10** | **Quarter 11** | **Quarter 12** | **Person\***  **days** |
| **Task 1** | Meeting with collaborators |  |  |  | 1st year report | Meeting with collaborators |  |  |  |  |  | Paper or presentation |  |
| **Person\*days** | 1700 | 1700 | 1700 | 1100 | 1100 | 1100 | 200 | 200 | 200 | 200 | 200 | 200 | 9600 |
| **Task 2** |  |  |  |  |  |  |  |  | Meeting with collaborators | Paper or presentation |  |  |  |
| **Person\*days** |  |  |  | 600 | 600 | 650 | 1000 | 1100 | 900 | 900 |  |  | 5750 |
| **Task 3** |  |  |  |  |  |  |  |  | 2nd year report |  |  | Meeting with collaborators |  |
| **Person\*days** |  |  |  |  |  |  | 650 | 640 | 900 | 900 | 1400 | 1400 | 5890 |
| **Task 4** |  |  |  |  |  |  |  |  |  |  |  | Final report. Paper or presentation |  |
| **Person\*days** |  |  |  |  |  |  |  |  |  |  | 600 | 600 | 1200 |
| **TOTAL** | 1700 | 1700 | 1700 | 1700 | 1700 | 1750 | 1850 | 1940 | 2000 | 2000 | 2200 | 2200 | 22440 |

### 8. Personnel Commitments

#### 8.1. Individual participants

### Leading Institution: NITI

#### Category I (weapon scientific and technical personnel)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Birth**  **Year** | **Scientific Title** | **Weapon**  **Expertise Ref.** | **Function in project** | **Daily rate**  **(US$)** | | **Total days** | | **Total grants**  **(US$)** | |
| Aniskevich Yuri Nickolayevich | 1946 | Ph.D. (Eng.) | 4.9 | Experimental data analysis | 30 | | 233 | | 6990 | |
| Bechta Sevostyan Victorovich | 1961 | Dr.Sci. (Eng.) | 4.8 | Project manager | 35 | | 450 | | 15750 | |
| Bliznyuk Valentina Grigoryevna | 1950 |  | 4.9 | Chemical analysis | 30 | | 390 | | 11700 | |
| Borisova Olga Rudolfovna | 1970 |  | 4.9 | Finance, accounting and test-related documentation | 25 | | 100 | | 2500 | |
| Bulygin Valentin Robertovich | 1967 |  | 4.9 | Experimental facilities technical servicing | 25 | | 440 | | 11000 | |
| Cheremiskin Vladimir Ivanovich | 1953 | Ph.D. (Eng.) | 4.9 | Experimental results analysis and processing | 30 | | 480 | | 14400 | |
| Chertkov Alexandr Alexandrovich | 1959 |  | 4.9 | Software for the information-measuring system | 30 | | 264 | | 7920 | |
| Filippov Evgeny Mikhailovich | 1948 | Ph.D. (Eng.) | 4.9 | Deliverables preparation and typography | 25 | | 170 | | 4250 | |
| Granovskaya Nadezhda Pavlovna | 1950 |  | 4.9 | State of the art review and surveys preparation | 30 | | 290 | | 8700 | |
| Granovsky Vladimir Semenovich | 1941 | Ph.D. (Eng.) | 4.9 | Thermalhydraulic calculations | 34 | | 480 | | 16320 | |
| Gusarov Victor Vladimirovich | 1952 | Dr.Sci. (Chem.), Prof. | 4.9 | Thermodynamic calculations, physicochemical analyses | 34 | | 500 | | 17000 | |
| Kalyago Elena Konstantinovna | 1952 |  | 4.9 | Experimental data acquisition, storage and processing | 33 | | 480 | | 15840 | |
| Kamensky Nickolai Evgenyevich | 1942 |  | 4.9 | Tests technical servicing | 30 | | 380 | | 11400 | |
| Khabensky Vladimir Bentsianovich | 1937 | Dr.Sci. (Eng.), Prof. | 4.9 | Tests planning and analysis | 34 | | 480 | | 16320 | |
| Kirin Gennady Semenovich | 1936 |  | 4.9 | Tests technical servicing | 25 | | 160 | | 4000 | |
| Kotova Svetlana Yuryevna | 1967 |  | 4.9 | Physicochemical analyses | 30 | | 480 | | 14400 | |
| Krushinov Evgeny Vladimirovich | 1960 |  | 4.3 | Tests preparation and performing | 34 | | 480 | | 16320 | |
| Kucherov Yuri Ivanovich | 1950 |  | 4.9 | Experimental facilities technical servicing | 30 | | 480 | | 14400 | |
| Kulagin Igor Vladimirovich | 1943 | Ph.D. (Phys.-Math.) | 4.7 | Experimental data mathematical processing | 30 | | 237 | | 7110 | |
| Lopukh Dmitry Borisovich | 1957 | Ph.D. (Eng.) | 4.9 | Electrothermics and experimental data processing. | 34 | | 450 | | 15300 | |
| Lysenko Anatoly Victorovich | 1963 |  | 4.9 | Temperature measurements | 33 | | 365 | | 12045 | |
| Martynov Alexandr Petrovich | 1963 |  | 4.9 | Preparation and servicing of the facilities’ electrical section | 30 | | 400 | | 12000 | |
| Martynov Valery Vladimirovich | 1953 |  | 4.9 | Metallographic analysis | 30 | | 380 | | 11400 | |
| Sabinin Vladimir Evgenyevich | 1936 | Ph.D. (Chem.) | 4.9 | Chemical analyses, laser equipment servicing | 34 | | 480 | | 16320 | |
| Smirnov Sergey Alexandrovich | 1957 | Ph.D. (Phys.-Math.) | 4.9 | Thermohydrodynamic calculations | 34 | | 355 | | 12070 | |
| Sulatsky Andrey Anatolyevich | 1961 | Ph.D. (Eng.) | 4.9 | Thermophysical processes modeling | 34 | | 480 | | 16320 | |
| Shevchenko Evgeny Vyacheslavovich | 1958 |  | 4.9 | Experimental facilities technical servicing | 30 | | 400 | | 12000 | |
| Vitol Sergey Alexandrovich | 1951 | Ph.D. (Eng.) | 4.9 | Physicochemical analyses | 34 | | 480 | | 16320 | |
| **Total:** | | | | | | **10764** | | **340095** | |

#### Category II (other scientific and technical personnel)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Birth**  **Year** | **Scientific Title** | **Function in project** | **Daily rate**  **(US$)** | | **Total days** | | **Total grants**  **(US$)** | |
| Almjasheva Oxana Vladimirovna | 1974 |  | SEM/EDX analysis | 30 | | 600 | | 18000 | |
| Almjashev Vyacheslav Iskhakovich | 1972 |  | Thermodynamic analysis | 30 | | 500 | | 15000 | |
| Belen’kiy Mikhail Yakovlevich | 1941 | Ph.D. (Eng.) | Thermodynamic analysis | 30 | | 480 | | 14400 | |
| Bezlepkin Pavel Victorovich | 1959 |  | Experimental facilities technical servicing | 30 | | 480 | | 14400 | |
| Bugrov Aleksander Nikolaevich | 1985 |  | Physicochemical analyses | 30 | | 240 | | 7200 | |
| Chepljuk Sergey Igorevich | 1982 |  | Experimental facilities technical servicing | 20 | | 302 | | 6040 | |
| Fadeyev Andrey Anatolyevich | 1959 |  | Equipment control | 20 | | 145 | | 2900 | |
| Gromov Vadim Andreyevich | 1981 |  | Experimental facilities technical servicing | 30 | | 480 | | 14400 | |
| Ignatov Alexandr Alexandrovich | 1950 |  | Equipment control | 20 | | 145 | | 2900 | |
| Kalyago Alexandr Petrovich | 1950 |  | Experimental results analysis and processing | 30 | | 480 | | 14400 | |
| Kirillova Svetlana Anatolyevna | 1981 |  | Thermodynamic analysis | 30 | | 600 | | 18000 | |
| Komlev Andrey Aleksandrovich | 1986 |  | Physicochemical analyses | 30 | | 180 | | 5400 | |
| Kondratiev Sergey Vladimirovich | 1985 |  | Physicochemical analyses | 30 | | 180 | | 5400 | |
| Kosarevsky Roman Alexandrovich | 1982 |  | Physicochemical analyses | 25 | | 520 | | 13000 | |
| Kuchayeva Saniya Kasimovna | 1947 |  | Thermodynamic analysis | 30 | | 600 | | 18000 | |
| Mezentseva Larisa Petrovna | 1949 | Ph.D. (Chem.) | X-ray structural analysis | 30 | | 600 | | 18000 | |
| Peregud Sergey Petrovich | 1954 |  | Experimental results analysis and processing | 30 | | 480 | | 14400 | |
| Poldyayeva Inessa Yuryevna | 1970 |  | Deliverables preparation and typography | 20 | | 150 | | 3000 | |
| Rudakov Vladimir Borisovich | 1952 |  | X-ray structural analysis | 30 | | 480 | | 14400 | |
| Shuvalov Sergey Vladimirovich | 1961 |  | Technical-organizational work | 20 | | 390 | | 7800 | |
| Talalaeva Tatyana Mikhailovna | 1955 |  | Deliverables preparation and typography, translation | 20 | | 390 | | 7800 | |
| Tolkachev Mikhail Dmitrievich | 1941 |  | X-ray phase analysis | 30 | | 600 | | 18000 | |
| Vavilov Anton Valer’evich | 1985 |  | Equipment control | 20 | | 302 | | 6040 | |
| **Total:** | | | | | **9324** | | **258880** | |

#### Category IV (personnel, who will work less than 10% of project duration)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of persons** | Function in project | **Daily rate**  **(US$)** | Total days | **Total grants**  **(US$)** |
| 4 | Experiments, specimen preparation and analysis | 20 | 260 | 5200 |
| **Total:** | | | **260** | **5200** |

### Participant Institution 1: ITES OIVT RAS

#### Category II (other scientific and technical personnel)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Birth**  **Year** | **Scientific Title** | **Function in project** | **Daily rate**  **(US$)** | **Total days** | **Total grants**  **(US$)** |
| Brykin Mikhail Vladimirovich | 1949 | Ph.D. (Phys.-Math.) | Development of the mathematical model of melting | 25 | 400 | 10000 |
| Senchenko Vladimir Nickolayevich | 1956 | Ph.D. (Phys.-Math.) | Leader of the group of high temperature measurements, in charge of tests performing | 25 | 500 | 12500 |
| Sheindlin Mikhail Alexandrovich | 1953 | Dr.Sci. (Phys.-Math.) | Assistant to the project manager in ITES; development of research methodology, tests performing | 30 | 660 | 19800 |
| Pakhomov Evgeny Panteleyevich | 1937 | Dr.Sci. (Eng.) | Study of materials phase composition | 25 | 400 | 10000 |
| **Total:** | | | | | **1960** | **52300** |

#### Category IV (personnel, who will work less than 10% of project duration)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of persons** | Function in project | **Daily rate**  **(US$)** | Total days | **Total grants**  **(US$)** |
| 2 | Experiments, specimen preparation and analysis | 20 | 132 | 2640 |
| **Total:** | | | **132** | **2640** |

#### 8.2. Managerial responsibilities

Task 1 Manager

Dr.Sci. (Phys.-Math.)

Sheindlin Mikhail Alexandrovich

Tasks 2, 3 Manager

Dr.Sci. (Chem.), Prof.,

Corr. Mem. RAS

Gusarov Victor Vladimirovich

Task 4 Manager

Krushinov Evgeny Vladimirovich

Project manager

Dr.Sci. (Eng.)

Bechta Sevostyan Victorovich

### 9. Financial Information

### TABLE 1

#### Estimated Aggregated Expenditures by Recipient

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Category** | **Quarters 1 & 2** | | **Year 1** | | **Year 2** | | **Year 3** | | **Total** | |
|  |  |  | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** |
| **1** |  | **Grant Payments:** |  |  |  |  |  |  |  |  |  |  |
|  | 1.1 | Category I |  | 57000 |  | 114000 |  | 114000 |  | 112095 |  | 340095 |
|  | 1.2 | Category II |  | 54000 |  | 108000 |  | 107300 |  | 95880 |  | 311180 |
|  | 1.3 | Category III |  |  |  |  |  |  |  |  |  |  |
|  | 1.4 | Category IV |  | 1270 |  | 2540 |  | 2650 |  | 2650 |  | 7840 |
|  |  | Total Grant Payments |  | **112270** |  | **224540** |  | **223950** |  | **210625** |  | **659115** |
| **2** |  | **Equipment:** |  |  |  |  |  |  |  |  |  |  |
|  | 2.1 | Capital Equipment |  | 223620 |  | 223620 |  | 0 |  | 0 |  | 223620 |
|  | 2.2 | Non-Capital Equipment |  | 6500 |  | 12274 |  | 0 |  | 0 |  | 12274 |
|  |  | *Total Equipment* |  | **230120** |  | **235894** |  |  |  |  |  | **235894** |
| **3** |  | Materials/Supplies |  | 4810 |  | 7250 |  | 3000 |  |  |  | **10250** |
| **4** |  | **Bank Fees** |  | 1810 |  | 3620 |  | 3270 |  | 2220 |  | **9110** |
| **5** |  | **Other Direct Costs:** |  |  |  |  |  |  |  |  |  |  |
|  | 5.1 | Technological Energy |  |  |  |  |  |  |  |  |  |  |
|  | 5.2 | Communications |  |  |  |  |  |  |  |  |  |  |
|  | 5.3 | Subcontracts/Seminars |  | 2700 |  | 5400 |  | 0 |  | 6250 |  | 11650 |
|  | 5.4 | Logistics/Customs |  | 800 |  | 2000 |  | 1200 |  | 0 |  | 3200 |
|  | 5.5 | Other |  | 200 |  | 400 |  | 400 |  | 400 |  | 1200 |
|  |  | *Total ODC* |  | **3700** |  | **7800** |  | **1600** |  | **6650** |  | **16050** |
| **6** |  | Travel: |  |  |  |  |  |  |  |  |  |  |
|  | 6.1 | Internal \*\*\* |  |  |  |  |  |  |  |  |  |  |
|  | 6.2 | Outside CIS |  | 4500 |  | 9000 |  | 8000 |  | 7103.61 |  | 24103.61 |
|  |  | *Total Travel* |  | **4500** |  | **9000** |  | **8000** |  | **7103.61** |  | **24103.61** |
|  |  | **Overhead/Retainage** |  |  |  |  |  |  |  |  | 21000 |  |
|  |  | ***Subtotals*** |  | **357210** |  | **488104** |  | **239820** |  | **226598.61** | **21000** | **954522.61** |
|  |  | **Totals** | **357210** | | **488104** | | **239820** | | **226598.61** | | **975522.61** | |

Remarks: \* (1) - Cash flow through Recipient Account

\*\* (2) - Cash flow through ISTC

\*\*\* Include Local and inside CIS travel

### TABLE 1-1

#### Estimated Aggregated Expenditures by Leading Institution:- NITI

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Category** | **Quarters 1 & 2** | | **Year 1** | | **Year 2** | | **Year 3** | | **Total** | |
|  |  |  | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** |
| **1** |  | **Grant Payments:** |  |  |  |  |  |  |  |  |  |  |
|  | 1.1 | Category I |  | 57000 |  | 114000 |  | 114000 |  | 112095 |  | 340095 |
|  | 1.2 | Category II |  | 45000 |  | 90000 |  | 90000 |  | 78880 |  | 258880 |
|  | 1.3 | Category III |  |  |  |  |  |  |  |  |  |  |
|  | 1.4 | Category IV |  | 850 |  | 1700 |  | 1750 |  | 1750 |  | 5200 |
|  |  | *Total Grant Payments* |  | **102850** |  | **205700** |  | **205750** |  | **192725** |  | **604175** |
| **2** |  | **Equipment:** |  |  |  |  |  |  |  |  |  |  |
|  | 2.1 | Capital Equipment |  | 200500 |  | 200500 |  |  |  |  |  | 200500 |
|  | 2.2 | Non-Capital Equipment |  | 6500 |  | 12274 |  |  |  |  |  | 12274 |
|  |  | *Total Equipment* |  | **207000** |  | **212774** |  |  |  |  |  | **212774** |
| **3** |  | Materials/Supplies |  | **4810** |  | **7250** |  | **3000** |  |  |  | **10250** |
| **4** |  | **Bank Fees** |  | **1650** |  | **3300** |  | **3000** |  | **2020** |  | **8320** |
| **5** |  | **Other Direct Costs:** |  |  |  |  |  |  |  |  |  |  |
|  | 5.1 | Technological Energy |  |  |  |  |  |  |  |  |  |  |
|  | 5.2 | Communications |  |  |  |  |  |  |  |  |  |  |
|  | 5.3 | Subcontracts/Seminars |  | 2700 |  | 5400 |  |  |  | 5200 |  | 10600 |
|  | 5.4 | Logistics/Customs |  | 800 |  | 1600 |  | 1200 |  |  |  | 2800 |
|  | 5.5 | Other |  | 200 |  | 400 |  | 400 |  | 400 |  | 1200 |
|  |  | *Total ODC* |  | **3700** |  | **7400** |  | **1600** |  | **5600** |  | **14600** |
| **6** |  | Travel: |  |  |  |  |  |  |  |  |  |  |
|  | 6.1 | Internal \*\*\* |  |  |  |  |  |  |  |  |  |  |
|  | 6.2 | Outside CIS |  | 3000 |  | 6000 |  | 5000 |  | 4191 |  | 15191 |
|  |  | *Total Travel* |  | **3000** |  | **6000** |  | **5000** |  | **4191** |  | **15191** |
|  |  | **Overhead/Retainage** |  |  |  |  |  |  |  |  | 17000 |  |
|  |  | ***Subtotals*** |  | **323010** |  | **442424** |  | **218350** |  | **204536** | **17000** | **865310** |
|  |  | **Totals** | **323010** | | **442424** | | **218350** | | **204536** | | **882310** | |

Remarks: \* (1) - Cash flow through Recipient Account

\*\* (2) - Cash flow through ISTC

\*\*\* Include Local and inside CIS travel

### TABLE 1-2

#### Estimated Aggregated Expenditures by Participant Institution 1:- ITES OIVT RAS

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Category** | **Quarters 1 & 2** | | **Year 1** | | **Year 2** | | **Year 3** | | **Total** | |
|  |  |  | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** |
| **1** |  | **Grant Payments:** |  |  |  |  |  |  |  |  |  |  |
|  | 1.1 | Category I |  |  |  |  |  |  |  |  |  | 0 |
|  | 1.2 | Category II |  | 9000 |  | 18000 |  | 17300 |  | 17000 |  | 52300 |
|  | 1.3 | Category III |  |  |  |  |  |  |  |  |  |  |
|  | 1.4 | Category IV |  | 420 |  | 840 |  | 900 |  | 900 |  | 2640 |
|  |  | *Total Grant Payments* |  | **9420** |  | **18840** |  | **18200** |  | **17900** |  | **54940** |
| **2** |  | **Equipment:** |  |  |  |  |  |  |  |  |  |  |
|  | 2.1 | Capital Equipment |  | 23120 |  | 23120 |  |  |  |  |  | 23120 |
|  | 2.2 | Non-Capital Equipment |  |  |  |  |  |  |  |  |  |  |
|  |  | *Total Equipment* |  | **23120** |  | **23120** |  |  |  |  |  | **23120** |
| **3** |  | Materials/Supplies |  |  |  |  |  |  |  |  |  |  |
| **4** |  | **Bank Fees** |  | **160** |  | **320** |  | **270** |  | **200** |  | **790** |
| **5** |  | **Other Direct Costs:** |  |  |  |  |  |  |  |  |  |  |
|  | 5.1 | Technological Energy |  |  |  |  |  |  |  |  |  |  |
|  | 5.2 | Communications |  |  |  |  |  |  |  |  |  |  |
|  | 5.3 | Subcontracts/Seminars |  |  |  |  |  |  |  | 1050 |  | 1050 |
|  | 5.4 | Logistics/Customs |  |  |  | 400 |  |  |  |  |  | 400 |
|  | 5.5 | Other |  |  |  |  |  |  |  |  |  |  |
|  |  | *Total ODC* |  |  |  | **400** |  |  |  | **1050** |  | **1450** |
| **6** |  | Travel: |  |  |  |  |  |  |  |  |  |  |
|  | 6.1 | Internal \*\*\* |  |  |  |  |  |  |  |  |  |  |
|  | 6.2 | Outside CIS |  | 1500 |  | 3000 |  | 3000 |  | 2912.61 |  | 8912.61 |
|  |  | *Total Travel* |  | **1500** |  | **3000** |  | **3000** |  | **2912.61** |  | **8912.61** |
|  |  | **Overhead/Retainage** |  |  |  |  |  |  |  |  | 4000 |  |
|  |  | ***Subtotals*** |  | **34200** |  | **45680** |  | **21470** |  | **22062.61** | **4000** | **89212.61** |
|  |  | **Totals** | **34200** | | **45680** | | **21470** | | **22062.61** | | **93212.61** | |

Remarks: \* (1) - Cash flow through Recipient Account

\*\* (2) - Cash flow through ISTC

\*\*\* Include Local and inside CIS travel

### 10. Equipment and Materials Summary

#### 10.1. Equipment Summary

### TABLE 2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EQUIPMENT/MATERIAL SUMMARY | | | | | | | | | | | | | | |
| **EQUIPMENT SUMMARY**  for Project Agreement #3813  To be provided in kind [ X ]  To be purchased by recipient [ ] | | | | | | | | | | | | | | |
| The ISTC will normally provide the most appropriate equipment that will perform the functions required; however, if very special reasons are given and explained in detail (Form PR-2E), the purchase of a particular make will be considered. | | | | | | | | | | | | | |
| **Please list items in the order of their priority and put an ‘X’ in the column next to “Item no.” if ISTC form PR-2E, “Data for a Single Equipment Item’, has been completed for a given item and is attached.** | | | | | | | | | | | | | |
| **Item**  **No.** | |  | | **DESCRIPTION OF ITEM** | | **Date needed (quarter)** | | **Qty** | **Unit cost**  **(USD)** | | | **Amount**  **(USD)** | |
| ***Leading Institution: NITI*** | | | | | | | | | | | | | |
| 1 |  | | Bench-top cutting machine MICROMET. Info@tspc.ru | | 1 | | 1 | | | 12400 | 12400 | |
| 2 |  | | RAYMR1SCCF pyrometer.  www.tekkno.ru; (812) 303-82-37 | | 1 | | 1 | | | 7900 | 7900 | |
| 3 |  | | EBARA 3M 32-200/4 pump.  “Tsentr otopleniya” LLC www.topka.ru. Tel. (812)579-87-37; 579-87-40. E-mail: topka @ inbox.ru | | 2 | | 1 | | | 1400 | 1400 | |
| 4 |  | | Gas flowmeters D-6250-HAB-CC-AV-15-0. SigmPlyus Co www.massflow.ru | | 3 | | 1 | | | 1288 | 1288 | |
| 5 |  | | Computer. www.lintek.ru 812 320-60-40 | | 4 | | 2 | | | 1425 | 2850 | |
| 6 |  | | VA2304B flowmeter 10 m3/h; www.aswega.ee; (price ex warehouse in Moscow) | | 1 | | 1 | | | 1260 | 1260 | |
| 7 |  | | VA2304B flowmeter 1,25 m3/h  www.aswega.ee; (price ex warehouse in Moscow) | | 1 | | 1 | | | 1260 | 1260 | |
| 8 |  | | KRT-7 Pressure gauge, accuracy class 1%; 16 bar;  Code 4862; Phone 43-2316; www.orlex.ru | | 2 | | 2 | | | 180 | 360 | |
| 9 |  | | СЕ 6202-С laboratory scales www.ntce.ru “NTCE” LLC (812) 766 1943, 768 1833 | | 2 | | 1 | | | 2220 | 2220 | |
| 10 |  | | Photocamera SONY DSLR-A200 (ALPHA)  kit (18-70, 75-300) with two lenses www.photoarena.ru (812) 912-8919 331-9663 | | 4 | | 1 | | | 1000 | 1000 | |
| 11 |  | | THORLABS FB470-10 Optical filter; Eurolase (495) 938-2100 124 2889; www.eurolase.ru | | 3 | | 2 | | | 155 | 310 | |
| 12 |  | | THORLABS FL532-10 Optical filter; Eurolase (495) 938 2100 124 2889; www.eurolase.ru | | 3 | | 2 | | | 163 | 326 | |
| 13 |  | | Information-measuring system (DAS);  FGUP EZAN; www.ezan.ac.ru; email:faa@ezan.ac.ru; Phone (496-52) 49097, 43597; Firsov Andrey | | 1 | | 1 | | | 40000 | 40000 | |
| 14 |  | | Utilities for SETARAM DT analyzer; “KOMEF” LLC; Phone/fax: (095) 916-1173, 916-1594, 916-1867; E-mail: komef@komef.ru; website: http://www.komef.ru | | 1 | | 1 | | | 9200 | 9200 | |
| 15 |  | | Quantax 200, EDS system , (“Bruker AXS Mirodndlysis GmbH”), ZAO “Nauchnie pribory”, SPb, (812) 251-28-50; sinstr@sinstr.ru | | 1 | | 1 | | | 95900 | 95900 | |
| 16 |  | | Component units for electron microscope Hitachi S-570 | | 1 | | 1 | | | 5460 | 5460 | |
| 17 |  | | SPI 11427-AX Sputter/Carbon Coater with Ultrasonic Cleaner SPI 07820-AX, SPI Supplies; USA; spi2spi@2spi.com | | 1 | | 1 | | | 10840 | 10840 | |
| 18 |  | | Robinson Backscattered Electron Detector Series 8.6, SPI Supplies; USA; spi2spi@2spi.com | | 1 | | 1 | | | 18800 | 18800 | |
| **Subtotal:** | | | | | | | | | | | **212774** | |
| ***Participant Institution 1: ITES OIVT RAS*** | | | | | | | | | | | | | |
| 19 | |  | | PDA-256-USB spectrometer, 450-900 nm, buffer memory 1000 spectr; Control Development Inc. | | 1 | | 1 | 4120 | | | 4120 | |
| 20 | |  | | 1HT15-15-12 optical table Honeycomb Table Tops with supports 1TS08-12-06-AS and additional rigging 5OM37-50, 1HB06-08-07,  *Standa P.O.Box 377,  03012 Vilnius, Lithuania Phone: +370-5-2651474* | | 1 | | 1 | 10974 | | | 10974 | |
| 21 | |  | | IPX-VGA210-G high-speed digital camera (with Gigabit Ethernet) ; *Imperx Incorporated; SEDATEC LLC; Anton Levenkov; +7 4956231275; Anton.Levenkov@sedatec.ru; www.sedatec.ru,* | | 1 | | 1 | 4325 | | | 4325 | |
| 22 | |  | | TDS-2024B oscillograph and 4 probes P-6509R/Pro; Tektronics Co | | 1 | | 1 | 3701 | | | 3701 | |
| **Subtotal:** | | | | | | | | | | | | **23120** | |
| **Estimated TOTAL COST:** | | | | | | | | | | | | **235894** | |

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#### 10.2. Materials Summary

### TABLE 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EQUIPMENT/MATERIAL SUMMARY | | | | | | | | | | | | | | |
| **MATERIAL SUMMARY**  for Project Agreement #3813  To be provided in kind [ X ]  To be purchased by recipient [ ] | | | | | | | | | | | | | | |
| The ISTC will normally provide the most appropriate equipment that will perform the functions required; however, if very special reasons are given and explained in detail (Form PR-2E), the purchase of a particular make will be considered. | | | | | | | | | | | | | |
| **Please list items in the order of their priority and put an ‘X’ in the column next to “Item no.” if ISTC form PR-2E, “Data for a Single Equipment Item’, has been completed for a given item and is attached.** | | | | | | | | | | | | | |
| **Item**  **No.** | |  | | **DESCRIPTION OF ITEM** | | **Date needed (quarter)** | | **Qty** | | **Unit cost**  **(USD)** | | **Amount**  **(USD)** | |
| ***Leading Institution: NITI*** | | | | | | | | | | | | | |
| 1 |  | | Copper sheets, rods, aluminium sheets, brass rods, hexahedrons, molybdenum rods. “Almet” LLC. www.almetal.ru" Phone. 327-0690 | | 4 | | 1 | | 2000 | | 2000 | |
| 2 |  | | Quartz glass items. Dzerzhinskii Gusev Glass Works. Phone. (49241) 95858, 95765. www.czd@rusglass.ru | | 5 | | 1 | | 3000 | | 3000 | |
| 3 |  | | Zirconia, specially pure, kg;  “Vekton” LLC; SPb ul. Academic Pavlov 12; www.vekton.prohim.ru | | 1 | | 20 | | 29.3 | | 586 | |
| 4 |  | | Carbonyl iron, specially pure 13-2, kg; “Vekton”LLC | | 1 | | 5 | | 7.8 | | 39 | |
| 5 |  | | Ferrous iron (II), chemically pure, kg; “Vekton”LLC | | 1 | | 10 | | 6 | | 60 | |
| 6 |  | | Quick lime, analytically pure, kg; “Vekton”LLC | | 1 | | 10 | | 4.6 | | 46 | |
| 7 |  | | Silicon (IV) oxide anhydrous, specially pure 8-4; kg; “Vekton”LLC | | 1 | | 10 | | 20 | | 200 | |
| 8 |  | | Aqueous ammonia (25-5), analytically pure, kg; “Vekton”LLC | | 1 | | 1 | | 1 | | 1 | |
| 9 |  | | Potassium pyrosulphate, analytically pure, kg; “Vekton”LLC | | 1 | | 5 | | 5.8 | | 29 | |
| 10 |  | | Granulated zinc, analytically pure, kg; “Vekton”LLC | | 1 | | 2 | | 9.7 | | 19.4 | |
| 11 |  | | Powdered nickel PNE-1 grade (any), kg; “Vekton”LLC | | 1 | | 1 | | 34.2 | | 34.2 | |
| 12 |  | | Graphite (powder) specially pure 7-4; “Vekton”LLC | | 1 | | 1 | | 2.4 | | 2.4 | |
| 13 |  | | Toluene, analytically pure, kg; “Vekton”LLC | | 1 | | 1 | | 3.5 | | 3.5 | |
| 14 |  | | Reference titres for рН measuring, packs; “Neva-reaktiv” LLC; SPb, ul. Sestroreckaya 8; www.nevareaktiv.ru | | 1 | | 1 | | 22.4 | | 22.4 | |
| 15 |  | | Quartz crucible, high, V-40 ml; “Neva-reaktiv” LLC | | 1 | | 20 | | 7.1 | | 142 | |
| 16 |  | | Quartz crucible, low, N-20 ml; “Neva-reaktiv” LLC | | 1 | | 20 | | 5.3 | | 106 | |
| 17 |  | | Volumetric flask 1-25-2 “Simax”; “Reachem” LLC; SPb; ul. 2-Luch 9, lit A; www.reachem.ru | | 1 | | 30 | | 10 | | 300 | |
| 18 |  | | Volumetric flask 1-50-2 “Simax”; “Reachem” LLC | | 1 | | 20 | | 11 | | 220 | |
| 19 |  | | Quartz cell for SF 10 mm; “Reachem” LLC | | 2 | | 5 | | 85 | | 425 | |
| 20 |  | | Gas pipette 1-200; “Reachem” LLC | | 1 | | 5 | | 9 | | 45 | |
| 21 |  | | Gas pipette 1-500; “Reachem” LLC | | 1 | | 5 | | 18 | | 90 | |
| 22 |  | | Flat-bottom flask, ground joint P-1-2000-29/32; “Reachem” | | 2 | | 5 | | 12 | | 60 | |
| 23 |  | | Beaker with spout, high, V-1-1000 TS; “Reachem” LLC | | 2 | | 10 | | 3.5 | | 35 | |
| 24 |  | | Beaker with spout, high, V-1-600 TS; “Reachem” LLC | | 2 | | 10 | | 2.4 | | 24 | |
| 25 |  | | Beaker with spout, high, V-1-400 TS; “Reachem” LLC | | 2 | | 10 | | 2 | | 20 | |
| 26 |  | | Beaker with spout, low, V-1-400 TS; “Reachem” LLC | | 2 | | 10 | | 2 | | 20 | |
| 27 |  | | Petri dish, polymeric, D 40; “Neva-reaktiv” LLC | | 2 | | 3 | | 95 | | 285 | |
| 28 |  | | Agate mortar with pestle V=50 ml; “Neva-reaktiv” LLC | | 2 | | 1 | | 450 | | 450 | |
| 29 |  | | Vacuum desiccator with cock 1-140; “Neva-reaktiv” LLC | | 1 | | 10 | | 50 | | 500 | |
| 30 |  | | China mortar; “Neva-reaktiv” LLC | | 2 | | 7 | | 13 | | 91 | |
| 31 |  | | China pestle; “Neva-reaktiv” LLC | | 2 | | 8 | | 3.7 | | 29.6 | |
| 32 |  | | Polyethylene washer V=500 ml; “Neva-reaktiv” LLC | | 2 | | 5 | | 10 | | 50 | |
| 33 |  | | Glass rods; “Neva-reaktiv” LLC | | 2 | | 30 | | 1 | | 30 | |
| 34 |  | | Filters AAF-ChA-20, packs; “Neva-reaktiv” LLC | | 2 | | 5 | | 20.5 | | 102.5 | |
| 35 |  | | Рroline pipette, single-channel 1-5 ml, variable volume; “Vekton”LLC | | 2 | | 1 | | 250 | | 250 | |
| 36 |  | | Color pipette tips 1-5 ml for single-channel variable volume Color pipette, packs; “Vekton”LLC | | 2 | | 2 | | 41 | | 82 | |
| 37 |  | | Liquid-filled thermometer SP-2PO+100/60; “Neva-reaktiv” | | 2 | | 2 | | 3 | | 6 | |
| 38 |  | | Liquid-filled thermometer SP-2PO+100/100; “Neva-reaktiv” | | 2 | | 3 | | 3 | | 9 | |
| 39 |  | | Liquid-filled thermometer SP-2PO+100/160; “Neva-reaktiv” | | 2 | | 4 | | 3 | | 12 | |
| 40 |  | | Rubber stopper, kg; “Neva-reaktiv” LLC | | 2 | | 4 | | 8 | | 32 | |
| 41 |  | | Crucible tongs L=210 mm; “Neva-reaktiv” LLC | | 2 | | 2 | | 10 | | 20 | |
| 42 |  | | Silicon tube, kg; “Neva-reaktiv” LLC | | 2 | | 3 | | 40 | | 120 | |
| 43 |  | | Brush for vials, big; “Neva-reaktiv” LLC | | 2 | | 20 | | 0.5 | | 10 | |
| 44 |  | | Brush for vials, small; “Neva-reaktiv” LLC | | 2 | | 20 | | 0.3 | | 6 | |
| 45 |  | | Protective apron, PVC< transparent; “Neva-reaktiv” LLC | | 2 | | 2 | | 5 | | 10 | |
| 46 |  | | Gloves, acid- and alkali-resistant; “Neva-reaktiv” LLC | | 2 | | 100 | | 1.55 | | 155 | |
| 47 |  | | Medical gloves, rubber; “Neva-reaktiv” LLC | | 2 | | 60 | | 0.5 | | 30 | |
| 48 |  | | DEM 105 pressure relay ;  Code 4862; Phone 43-23-16; www.orlex.ru | | 3 | | 4 | | 60 | | 240 | |
| 49 |  | | DRA30-24 power source; www.eltech.spb.ru | | 3 | | 4 | | 50 | | 200 | |
| **Subtotal:** | | | | | | | | | | | **10250** | |
| **Estimated TOTAL COST:** | | | | | | | | | | | **10250** | |

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#### 10.4. Other Direct Costs Summary

### TABLE 4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| OTHER DIRECT COSTS SUMMARY | | | | | | | |
| **OTHER DIRECT COSTS SUMMARY**  for Project Agreement #3813  To be provided in kind [ X ]  To be purchased by recipient [ ] | | | | | | | |
|  | | | | | | |
| **Detailed breakdown of Other Directs Costs to include planned activities under items 5.1, 5.2, 5.3, 5.4, 5.5 from Table 1 of the Project Agreement** | | | | | | |
| **Item**  **No.** |  | **DESCRIPTION OF ITEM** | **Date needed (quarter)** | **Qty** | **Unit cost**  **(USD)** | **Amount**  **(USD)** |
| ***Leading Institution: NITI*** | | | | | | |
| 1 | 5.3 | Organization of a meeting with collaborators | 1,3 | 2 | 2700 | 5400 |
| 2 | 5.3 | Organization of a meeting with collaborators | 11 | 1 | 5200 | 5200 |
| 3 | 5.4 | Customs expenses | 1-7 | 7 | 400 | 2800 |
| 4 | 5.5 | Equipment repair and maintenance | 1-12 | 12 | 100 | 1200 |
| **Subtotal:** | | | | | | **14600** |
| ***Participant Institution 1: ITES OIVT RAS*** | | | | | | |
| 5 | 5.3 | Conducting a workshop | 9 | 1 | 1050 | 1050 |
| 6 | 5.4 | Customs expenses | 4 | 1 | 400 | 400 |
| **Subtotal:** | | | | | | **1450** |
| **Estimated TOTAL COST:** | | | | | | **16050** |

Form PR-1OD of 3/04