

## Activity report for 2024-2025

### *D.I. Mendeleev Institute for Metrology*

At the time of May 2026, VNIIM has 7 state primary standards in the field of thermometry and measurement of thermophysical quantities, 127 CMC lines. Department of temperature and thermophysical quantities has 43 employees, including 12 with PhD degree.

#### 1. International activities:

##### 1.1 International comparisons:

- APMP Key Comparison of water-triple-point cells (APMP.T-K7.2021). Five participants, including VNIIM, have completed comparison measurements, and the pilot laboratory (KRIS, South Korea) has prepared draft A.
- The COOMET 882/RU/23 project "Comparison of ampoules of the triple point of water of the COOMET member countries". A technical protocol is being prepared. The coordinator of the topic and the pilot of the comparisons is VNIIM. The proposed participants are NMI Belarus, Kazakhstan, and Uzbekistan.
- COOMET 897/RU/24 project "Comparisons in the field of measurement of combustion energy of high purity benzoic acid". The coordinator of the topic and the pilot of the comparisons is VNIIM. Participants are NMI of China, Belarus, Russia, Turkey. Comparisons are registered, measurements are being carried out.
- Project COOMET 873/RU-a/2023 (COOMET.T-S6) "Comparisons in the field of measurements of combustion energy of pure organic substances". The final report on the results of the comparisons has been completed.
- Pilot comparisons in the field of measuring the temperature coefficient of linear expansion. Possible participants in the comparisons are determined (VNIIM, NIM (China), ...).
- Additional comparisons on the measurement of thermal conductivity using the hot plate method with a protected area (APMP.T-S10). Measurements have been completed, and draft A is being prepared.

##### 1.2 Other international activities

- A training seminar in the field of thermometry and humidity measurements for CEEMS countries was held on September 10-11.
- VNIIM employees participated in two meetings of the Technical committee on thermometry TC 1.10 COOMET, and in two meetings of TCT APMP.

#### 2. Scientific activities:

2.1 Project "Kelvin-3": Investigation of a set of high-temperature fixed points based on eutectic alloys for the purpose of determining thermodynamic temperature. Development and research of a set of cells with high-temperature eutectic alloys: Fe-C (1153 °C), Ru-C (1953 °C), ZrC-

C (2882 °C) and HfC-C (3185 °C). The project is being implemented jointly with VNIIOFI. At the moment, pure substances have been obtained, the cells design and the method of their melting have been developed.

2.2 Project “Minicells”: the creation of miniature fixed point cells based on low-temperature eutectic alloys for thermometers installed in hard-to-reach places, including for meteorology. Currently, several cell design options have been developed, and alloys have been selected (Ga-Sn-Zn: -6.65 °C, Ga-In-Sn: 4.85 °C, Ga-In: 15.65 °C, Ga-Sn: 20.48 °C, Ga-Zn: 25.21 °C, Ga-Al: 26.60 °C), measurements were carried out to reproduce the phase transition in the climate chamber and in the field.

2.3 Project “Salt”: searching of substances suitable for reproducing fixed values of relative humidity. At the moment, 12 candidate substances have been studied to reproduce fixed relative humidity values above a saturated water solution of the substance. The stability of solutions and reproduction of relative humidity at different temperatures are investigated.

2.4 Project “Quantum Calibrator”: a study of the possibility of temperature measurements using the quantum spontaneous parametric scattering (SPS) effect. The project is being implemented jointly with Moscow State University. At the moment, the necessary optical scheme and range of wavelength are being selected to obtain adequate measurement accuracy.

2.5 Project "Wobbe": development of methods and means of transmitting the unit of the Wobbe number. A method for measuring the Wobbe number has been developed, and two-parameter reference samples of the lowest volumetric heat of combustion and the lowest Wobbe number of gases and gas mixtures have been created. The project is completed.

2.6 Investigation of the nominal static characteristics of the iridium-rhodium 40%-iridium thermocouple (IrRd40-Ir) and the metrological characteristics of thermometers based on it. The iridium-rhodium 40%-iridium thermocouple (IrRd40-Ir) has been studied for stability and hysteresis in the temperature range from 1800 to 2100 °C. A search is underway for wire manufacturers of the required composition.