

Main results obtained within Phase 1 / 2025

Sample fabrication was carried out in accordance with a strict protocol developed within this project. The laboratory protocol includes details regarding sample mixing, stabilization, and the equipment used.

The samples were prepared in two categories:

- PEG-based nanofluids
- surfactant-based nanofluids

The working methodology followed the steps specified in the working protocols developed within this project:

- protocol for the preparation of nanofluids (PEG pillar and surfactant pillar)
- protocol for thermal conductivity testing (C-Therm and Thermtest)
- protocol for electrical conductivity and pH testing
- protocol for viscosity testing

These protocols were developed by the project team members and represent a novelty.

The equipment used during this phase can be divided into three categories:

- equipment available in the laboratory at the start of the project: C-Therm thermal conductivity measurement system, Netzsch DSC equipment, Hanna equipment for electrical conductivity and pH testing;
- equipment purchased through the project: thermal conductivity measurement device with THW Thermtest sensor, IKA viscometer, sample heating equipment (CBC visc-lite and Rotatemp), electrical conductivity sensor;
- equipment available through cooperation with the “Petru Poni” Institute of Macromolecular Chemistry, Iași (SEM, DSC, NMR).

All equipment is presented on the project website (<https://fluidexap.tuiasi.ro/en/related-information/>) and on the laboratory website: <https://atnano.sim.tuiasi.ro/>

The data obtained within Phase 1 / 2025 were published as follows:

Details / Link	Published data
A complex investigation of electrical conductivity and pH of polyethylene glycol nanocolloids N Cojocariu, El Chereches, D Bejan, AA Minea Journal of Molecular Liquids (2025) 128880 doi: https://doi.org/10.1016/j.molliq.2025.128880	Data on the stability of PEG-based nanofluids, electrical conductivity, and pH analyses
PEG 200/400 mixture and metallic/oxide nanoparticles nanocolloids: Experimental evaluation of thermophysical properties N Cojocariu, C Tugui, El Chereches, AA Minea Journal of Energy Storage 141 (A) (2026) 119129 doi: https://doi.org/10.1016/j.est.2025.119129	Data on the influence of nanoparticle type on thermal conductivity, viscosity, specific heat, and density for F4-based nanofluids.

<p>Nanocolloids Based on PEG Mixtures with Several Nanoparticles: Experimental Study on Viscosity, Thermal Conductivity, Density and Isobaric Heat Capacity N Cojocariu, CA Tugui, El Cherecheș, AA Minea International Journal of Thermophysics 46 (10) (2025), 1-21 doi: https://doi.org/10.1007/s10765-025-03621-6</p>	<p>Data on the influence of nanoparticle type on thermal conductivity, viscosity, specific heat, and density for F3-based nanofluids.</p>
<p>Experimental Studies on Developing Novel Nanocolloids Based on PEG Mixtures and Different Nanoparticles: Insights into Thermal Conductivity and Effusivity N. Cojocariu, E.I. Cherecheș, D. Bejan, B. Pricop, A.A. Minea International Journal of Thermophysics (2025) doi: https://doi.org/10.1007/s10765-025-03665-8</p>	<p>Complete data on the thermal conductivity of all suspensions within the PEG pillar and their interpretation.</p>
<p>Studies on several mixtures of PEG based phase change materials for heat transfer Applications: An experimental approach D. Bejan, N. Cojocariu, E.I. Cherecheș, A.A. Minea Journal of Molecular Liquids, 429 (2025) 127652 doi: https://doi.org/10.1016/j.molliq.2025.127652</p>	<p>Experimental data and a comprehensive study of PEG-based mixtures.</p>
<p>Surfactants for heat exchange nanocolloids: Review of advantages, drawbacks, quantitative information and recommendations AA Minea Thermal Science and Engineering Progress 65 (2025) 103983 doi: https://doi.org/10.1016/j.tsep.2025.103983</p>	<p>Review paper on the selection of surfactants for nanofluids. This review formed the basis for the preparation of surfactant-based nanofluids.</p>
<p>An experimental study on the influence of different new surfactants on nanocolloids properties G. Tofan, C.A. Tugui, E.I. Cherecheș, D. Bejan, B. Pricop, A.A. Minea Emerging Materials Global Network (EMGN) 2025, 1-3 September 2025, Istanbul, Turkey https://2025.emgn-meeting.org/</p>	<p>Preliminary data on surfactant-based nanofluids, including data on the thermal conductivity of the suspensions.</p>
<p>Surfactant influence on high loaded nanofluids: a study on thermal effusivity G. C. Tofan, C. A. Tugui, N. Cojocariu, E. I. Cherecheș, D. Bejan, B. Pricop, A. A. Minea International Conference on Applied Sciences, ICAS 2025, 29.05. – 31.05.2025, Hunedoara – Romania https://icas.fih.upt.ro/</p>	<p>Data on the thermal effusivity of surfactant-based suspensions.</p>

Highlighting the Main Results of Phase 1 / 2025

The main results of the project are:

- Development of innovative base fluids based on polyethylene glycol mixtures (international novelty).
- Preparation of a large number of suspensions using four base fluids (water, PEG 200, and two suspensions with PEG 200 + PEG 400 mixtures), a wide range of surfactants (12 types of surfactants: SDBS, SDS, CTAB, PSS, PVP, T80, F127, J12, PEG 200, PEG 400, an ionic liquid, and an industrial surfactant), and six types of nanoparticles: MWCNT, MgO, Cu, Ag, Al₂O₃, TiO₂.
- Measurement of the thermophysical properties of nanofluids (density, thermal conductivity, thermal effusivity, viscosity, electrical conductivity, specific heat, pH) at ambient temperature, as well as their variation with temperature.
- Study of the influence of nanoparticle concentration and nanoparticle type on thermophysical properties.
- Study of the influence of surfactant type and quantity on thermophysical properties.
- Generation of experimental correlations for all studied thermophysical properties, for each type of nanofluid.

All these results were published in top international journals such as:

- Journal of Energy Storage (ELSEVIER), Q1, FI 9.8
- Thermal Science and Engineering Progress (ELSEVIER), Q1, FI 5.4
- Journal of Molecular Liquids (ELSEVIER), Q1, FI 5.2
- International Journal of Thermophysics (SPRINGER) Q2, FI 2.9

Result Indicators

For Phase 1, year 2025, all indicators were met, as follows:

Result Indicator	Contracted Number for Phase 1 / 2025	Number as of 30.12.2025	Comment
Number of peer-reviewed scientific publications submitted to Q1/Q2 journals	1	2 under review (Q1)	indicator exceeded by 100%
Number of peer-reviewed scientific publications published	1	7 published (4 Q1 and 3 Q2)	indicator exceeded by 700%
Number of conference participations	2	8	indicator exceeded by 400%
Number of patent applications	–	–	–
Number of applications for additional funding within Horizon Europe	–	1	indicator exceeded by 100%
Number of meetings (workshops, round tables, etc.)	1	1	indicator fulfilled