Project acronym:
FluidExAp

Project title:
NEW HEAT TRANSFER FLUIDS FOR HEAT EXCHANGE APPLICATIONS

Contract nr. 18 PCE / 08.01.2025
Project financed by Ministerul Cercetării, Inovării şi digitalizării,
CNCS - UEFISCDI, PNCDI IV

Start date of project: 8 .01.2025
Project duration: 36 month

Deliverable no. D2.4

REPORT TO FUNDING ORGANIZATION AND DISSEMINATION OF PARTIAL RESULTS REGARDING THERMOPHYSICAL PROPERTIES

Due date of deliverable	31/03/2026	
Author	Alina Adriana MINEA	
Status	Final	
Dissemination level	PU / CO	
Approved	30/03/2026	Alina Adriana MINEA

1. Report at the end of Activity 2

1.1. Requests from the application form

The application form has 4 deliverables for A2, from which:

Deliverables:

D2.2. Report on the thermophysical properties of nanofluids

D2.3. Report on the correlation of thermophysical properties

D2.4. Report to the contracting authority and dissemination of partial results regarding thermophysical properties

Key milestones:

M2.1. Trustable correlations for NFs thermophysical properties

A2. Experimental tests for morphology and thermophysical properties determination.

Tasks:

A2.1. Acquisition of equipment and experimental determination of thermophysical properties;

A2.2. New correlations for variation of thermophysical properties of the new fluids;

A2.3. Dissemination of partial results (thermophysical properties)

All the developed fluids will be fully characterized in terms of stability (zeta, pH), SEM, TEM, pH, electrical and thermal conductivity, viscosity, specific heat, density. We will consider also the effect of particle size distribution on the properties of the nanofluids and several characterization activity is envisaged, whereas we will check the interaction with the different bulk fluids that might induce aggregation phenomena Further on, the variation of thermophysical properties with temperature will be considered as a primary goal since little to no such a studies exists. New correlations are envisaged to fully describe the developed NF nanofluids. The feedback loop is with A1 and results will be adjusted in terms of concentration and NP type, dimension, surfactant.

1.1.2. Achievements in the project

This work was supported by a grant of the Ministry of Research, Innovation and Digitization,
CNCS-UEFISCDI, project number PN-IV-P1-PCE-2023-0171 within PNCDI IV, grant no.18PCE/08.01.2025.

Since the beginning of the project, the procurement of materials and equipment has been started, so there were no delays.

The table presents a comparative analysis of what was written in the funding application and what was achieved within the project. The comments column provides justifications in case of deviations.

Text in the application form	Accomplished	Observations
All the developed fluids will be fully characterized in terms of stability (zeta, pH), SEM, TEM, pH, electrical and thermal conductivity, viscosity, specific heat, density. We will consider also the effect of particle size distribution on the properties of the nanofluids and several characterization activity is envisaged, whereas we will check the interaction with the different bulk fluids that might induce aggregation phenomena.	All the nanoparticles were characterized in terms of SEM and XRD. Several suspensions were characterized in terms of SEM and DSC. All the samples were studied in terms of pH, electrical and thermal conductivity, viscosity, specific heat, density. We studied the effect of nanoparticles under 3 kinds og PEG mixtures and compared with previous PEG 400 tests.	It was not possible to study the particle size effect due to extensive studies on suspensions.
Further on, the variation of thermophysical properties with temperature will be considered as a primary goal since little to no such a study exists.	The variation of all studied thermophysical properties with temperature was accomplished and results are published in high impact journals.	
New correlations are envisaged to fully describe the developed NF nanofluids.	Correlations for all studied thermophysical properties with temperature were accomplished and results are published in high impact journals. Plus, the correlations were structured on several directions, as: nanoparticle type influence, nanoparticle concentration influence, temperature influence and surfactant type and concentration influence.	

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The feedback loop is with A1 and results will be adjusted in terms of concentration and NP type, dimension, surfactant.	The feedback loop indicated that most regular surfactants influence was negative in terms of foam occurrence. Plus, PEG mixtures behave better than simple PEGs in laminar flow. Results discussion and conclusion are published in high impact journals.	

Experimental results were presented at conferences and published in prestigious journals.

Conferences (5)

- **Nanocolloids: Experimental Insights and AI Integration**
  A A Minea
  7th International Conference on Fluid Flow and Thermal Science (ICFFTS 2026)
  London, United Kingdom - October 28 - 30, 2026
  https://icffts.com/speakers.html
- **Insights into surfactant influence on TiO2 water nanocolloids**
  G.C. Tofan, M. Lohan, A.A Minea
  HMT-PM 2026: The Second International Conference on Heat and Mass Transfer in Porous Media: Fundamentals and Applications (HMT-PM 2026); co-sponsored by ICHMT, October 19-23, 2026, Praga, Czech Republic
- **Surfactants for nanocolloids stability – an experimental approach**
  G. C. Tofan, C. A. Tugui, E. I. Chereches, B. Pricop, A. A. Minea
  17th International Conference on Thermal Engineering: Theory and Applications, June 22-24, 2026, Valetta, Malta
- **Experimental insights into surfactant advantages and drawbacks on nanocolloids for heat transfer applications**
  GC Tofan, CA Tugui, D Bejan, B Pricop, AA Minea
  3rd International Conference on Engineering Manufacture (EM2026) Porto (FEUP), Portugal, 7-8 May 2026
- **Nanocolloids as Heat Transfer Fluids: Advantages, Limitations, and Protocol Considerations**
  AA Minea
  11th World Congress on Momentum, Heat and Mass Transfer, Paris, France, April 2026

Articles in journals (6, from which 3 Q1 and 3 Q2)

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- **Experimental Investigation of Surfactant Addition Influence on the Properties of Titanium Oxide Water Nanofluid**
  GC Tofan, CA Ţugui, L. Atanase, D. Bejan, AA Minea
  International Journal of Thermophysics 47, 72, 2026
  https://doi.org/10.1007/s10765-026-03747-1
- **Experimental study on SDBS surfactant effect on titanium oxide water nanofluid properties**
  GC Tofan, B PRicop, CA Ţugui, AA Minea
  Alexandria Engineering Journal 141, 132-137, 2026
  https://doi.org/10.1016/j.aej.2026.03.019
- **Polyethylene Glycol Nanocolloids as Advanced Phase Change Materials for Sustainable Energy: Experimental Data on Viscosity, Density, and Isobaric Heat Capacity**
  CA Ţugui, N Cojocariu, B Pricop, D Bejan, AA Minea
  Polymers 18 (6), 673, 2026
  https://doi.org/10.3390/polym18060673
- **Experimental Insights into Influence of Surfactants on Thermophysical Properties of a Titanium Oxide Water Nanofluid**
  GC Tofan, B Pricop, CA Ţugui, AA Minea
  Applied Sciences 16 (4), 1890, 2026
  doi: https://doi.org/10.3390/app16041890
- **Peg based nanocolloids for heat transfer applications: a study on heat transfer enhancement in laminar flow**
  G.C. Tofan, N. Cojocariu, A.C. Ţugui, B. Pricop, M.N. Lohan, E.I. Chereches, D. Bejan, A.A. Minea
  Journal of Thermal Analysis and Calorimetry, 2026, Springer
  doi: https://doi.org/10.1007/s10973-025-15203
- **PEG 200/400 mixture and metallic/oxide nanoparticles nanocolloids: Experimental evaluation of thermophysical properties**
  N Cojocariu, C Tugui, EI Chereches, AA Minea
  Journal of Energy Storage 141 (A) (2026) 119129
  doi: https://doi.org/10.1016/j.est.2025.119129

Articles under review: 4

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