MICRO NANO SYSTEMS RESEARCH CENTER (AFM Lab + Tribology Lab)

Contact details

Name	**Micro Nano Systems RESEARCH CENTER**
Acronym	**MiNaS**
Logo	MiNaS Micro-Nano Systems Laboratory *Engineering the Future from Micro to Nano*
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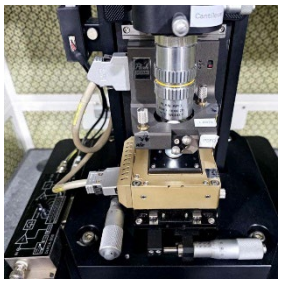

Areas of expertise

The MiNaS research centre covers a broad range of expertise spanning Micro & Nano Systems (MEMS/NEMS), nanomechanical and nanotribological characterization, as well as the study of friction, wear and adhesion at the nano scale. Research activities include the deposition and mechanical/tribological characterization of thin films, reliability design and lifetime estimation of MEMS structures, and the development of microsystems for space, telecommunications and optical applications, including micromembranes with multiple degrees of freedom. The centre also specializes in the tribological, and mechanical characterization of composite materials reinforced with glass, basalt and carbon fibers, as well as the evaluation of lubricants and nanoparticle-based additives (TiO_2, MoS_2, Ag, motor oils) across standard, micro and industrial tribology scales. Further research directions include green and sustainable tribology (Green & Smart Tribology), marine and corrosive environment tribology within the Ocean Tribology Centre network (COST CA23155), triboinformatics and AI-driven wear prediction, material testing under harsh space conditions, FEM modelling with evolutionary optimization algorithms, and the development of nanotechnologies for mass sensors and environmental biosensors.

Team

Prof. Dr. Eng. Marius PUSTAN; Prof. Dr. Eng. Corina BIRLEANU; Prof. Dr. Eng. Simion HARAGAS; Assoc. Prof. Dr. Mat. Florina SERDEAN; Assoc. Prof. Dr. Eng. Florin POPISTER; Assoc. Prof. Dr. Eng. Ovidiu BUIGA; Lecturer Dr. Eng. Violeta MERIE; Lecturer Dr. Eng. Horea CRISAN; Lecturer Dr. Eng. Claudiu POPA; Dr. Eng. Mircea CIOAZA; PhD stud. Eng. Florin POP; PhD stud. Eng. Horea Stefan GOIA; PhD stud. Eng. Adelina MAN; PhD stud. Eng. Paul PIRJA; PhD stud. Eng. Paul CIUDIN; Eng. Daniel PUSTAN

Representative projects

GSTrib – Green and Smart Tribology (GAP-101241089 – 2025-2027); EU-COST Action CA23155 – 2024-2028 – Ocean Tribology Center (OTC); MatSpaceTEG – Materiale pentru generatoare termoelectrice spatiale 2017-2019; MEMSMAT – Tribomechanical Characterization of MEMS for Space – 2013-2016; REDEMS – Reliability RF-MEMS switches for space 3SMVIB – 3-Scale modelling for vibrating micro sensors – 2012-2015; ROBOGRIP – Microgrippers as end-effectors for microrobotics- 2012-2015; ROMEC – Comutator MEMS cu contact metalic robust– 2017-2019; multiDOF; Micromembrane cu multiple grade de libertate- 2015-2017; NARDEMS – Nanomechanical characterization of MEMS resonators – 2011-2014.

Significant results

The most representative publications of the past 5 years:

1. Birleanu, C., Pustan, M. et al. (2026) - Dry Sliding Adhesion and Wear Behavior of LPBF Ti-6Al-4V ELI (Grade 23): Influence of In-Layer Remelting on Microstructure, Surface Integrity, and Tribolayer Stability, Appl. Sci. 2026, 16(7),
2. Birleanu, C., Pustan, M., Cioaza, M. et al. (2022) – Effect of TiO2 nanoparticles on the tribological properties of lubricating oil. Scientific Reports, 12, 5201. [Q1 – IF 3.8]

3. Birleanu, C., Pustan, M., Pop, G., Cioaza, M. et al. (2022) – Tribological behaviors of carbon fiber reinforced polymer composites under boundary lubrication. Polymers, 14(18), 3716. [Q1 – IF 4.7]
4. Birleanu, C., Pustan, M., Cioaza, M. et al. (2023) – Tribo-mechanical investigation of glass fiber reinforced polymer composites under dry conditions. Polymers, 15(12), 2733. [Q1 – IF 4.7]
5. Birleanu, C., Cioaza, M. et al. (2023) – Tribological investigation of glass fiber reinforced polymer composites via ELECTRE decision-making method. Polymers, 16(1), 62. [Q1 – IF 4.7]
6. Birleanu, C., Udroiu, R., Cioaza, M. et al. (2025) – The Effect of Fiber Weight Fraction on Tribological Behavior for Glass Fiber Reinforced Polymer. Polymers, 17(1), 91. [Q1 – IF 4.9]
7. Birleanu, C., Bere, P., Udroiu, R., Cioaza, M., Pustan, M. (2025) – Impact of CuSn powder on Mechanical Properties and Tribological Performance of Novel Basalt Fiber Reinforced Hybrid Composites. Polymers. [Q1 – IF 4.9]
8. Birleanu, C., Udroiu, R., Cioaza, M. et al. (2025) – Tribomechanical Analysis and Performance Optimization of Sustainable Basalt Fiber Polymer Composites. Technologies. [Q1]
9. Birleanu, C., Udroiu, R., Cioaza, M. et al. (2025) – Basalt vs. Glass Fiber-Reinforced Polymers: A Statistical Comparison of Tribological Performance Under Dry Sliding Conditions. Journal of Composites Science. [Q2 – IF 3.6]
10. Birleanu, C., Cioaza, M., Suciu, R.C. et al. (2025) – Tribological Performance of SAE 10W-40 Engine Oil Enhanced with Thermally Treated TiO2 Nanoparticles. Lubricants, 13(11), 466. [Q2]

Significant solutions:

Development of a new method to estimate the stiffness of micro/nano flexible structures by atomic force microscopy
Experimental determination of energy dissipation in oscillating MEMS structures for lifetime improvement
Design – Fabrication – Testing of reliable mass-detection cantilever sensors.
Design – Fabrication – Testing of micromembranes with high flexibility for optical and RF applications
Software development for lifetime estimation of vibrating MEMS structures
Advanced nano-investigations of dental and biomedical materials by AFM
Development of statistical methods (ANOVA) and multi-criteria decision tools (ELECTRE) for tribological material selection
AI-based and triboinformatics solutions for wear prediction in industrial tribosystems

Products and technologies:

Micromembranes for optical and RF MEMS applications
Paddle MEMS cantilevers for mass detection and environmental biosensing
Electrostatically actuated resonators.
MEMS lifetime estimation software
Tribological database for nanoparticle-enhanced lubricants (TiO_2, MoS_2, Ag, CuSn)
Modified tribometer device for gear contact simulation

The offer addressed to the economic environment

Research and Development Services	Macro, micro and nano tribological characterization (oils, materials, surfaces) Nanomechanical characterization by AFM (hardness, elastic modulus, stiffness) Reliable design of micro and nano systems (MEMS/NEMS) FEM modelling and simulation of micro and nano components Composite material testing – friction, wear, thermal behaviour Tribological investigations for the automotive, aerospace and medical industries
Consulting	Team members provide specialized consulting across all centre expertise areas: lubricant and additive selection, friction and wear analysis, tribological characterization of composite materials and thin films, as well as fault diagnosis in industrial mechanical systems. In nanomechanics and MEMS reliability, the team supports reliable microsystem design, lifetime estimation and FEM-based optimization. Consulting also covers emerging fields such as triboinformatics, AI-driven wear prediction and green tribology.
Training	The MiNaS team has extensive experience in academic and professional training, covering MEMS/NEMS design and simulation, AFM-based nanomechanical and nanotribological characterization, standard and micro-tribology, composite material testing, and FEM modelling. Team members have served as invited lecturers at universities in Austria, Italy, Germany, Belgium, Poland and Spain. Through the Erasmus Mundus project GSTrib (2025–2027) and the EU COST Action CA23155 – Ocean Tribology Center, the team contributes to international training and research networks at the intersection of tribology, sustainability and digital solutions.