Nanotechnology and Materials Science Research Group

Our research group is dedicated to advancing the fields of advanced materials science, surface engineering, and nanotechnology through a diverse portfolio of scientific projects. A core focus of our activity involves the development and microstructural characterization of hard nanocomposite coatings, such as TiAlSiN/Si3N4 and nc-(TiAlN)/a-Si3N4 thin layers, engineered via reactive PVD-UM deposition technologies and analyzed through advanced transmission electron microscopy (TEM and XTEM) to achieve superior anti-wear properties. In addition to hard coatings, we investigate the structural formation and photocatalytic potential of titanium oxynitride thin-film structures, as well as the production of polymer nanofibers at the nanoscale. Our expertise also extends into biomedical applications and medical device engineering; we conduct structural investigations of nano dimensional gold particles in colloidal solutions for molecular biology and medicine, analyze technological parameters for precision laser cutting of medical stents, and explore advanced laser surface treatments for titanium alloy implants to enhance their performance and biocompatibility.

Members

- dr. Biró Domokos
- dr. Jakab-Farkas László
- dr. Bitay Enikő
- dr. Gergely Attila Levente
- dr. Kántor József
- drd. Hodgyai Norbert
- drd. Gál Károly István
- drd. Farmos Rudolf

Partner institutions

- "George Emil Palade" University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș
- Budapest University of Technology and Economics, Hungary
- John von Neumann University, Hungary
- Óbuda University, Budapest, Hungary
- Çanakkale Onsekiz Mart University – Turkey

Research Grants

- Klebelsberg Kuno scholarship 2023-2026.
- MTA Domus Scholarship 2020 – 2026
- Sapientia Foundation—Institute for Scientific Research (2022-2023, 2025-2026)

Recent publications

1. Gergely A.L.*, Farmos R.L., Kántor J.*, Kántor A. É., Hodagyi N., Recycled PET nanofiber membranes for air filtration. In 2022 IEEE 22nd International Symposium on Computational Intelligence and Informatics and 8th IEEE International Conference on Recent Achievements in Mechatronics, Automation, Computer Science and Robotics (CINTI-MACRo) IEEE, 2022, 57-62.
2. Kántor J.*, Gergely A.L.*, Farmos R.L., Hodgyai N., Poly (styrene-b-isobutylene-b-styrene) Triblock Copolymer Fiber Generation with Centrifugal Spinning, and its Potential Application in Oil Collection. In 2022 IEEE 22nd International Symposium on Computational Intelligence and Informatics and 8th IEEE International Conference on Recent Achievements in Mechatronics, Automation, Computer Science and Robotics (CINTI-MACRo) IEEE, 2022, 77-82.
3. Bitay E, Gergely A.L*., Kántor J., Szabó ZI, Evaluation of Lapatinib-Loaded Microfibers Prepared by Centrifugal Spinning. Polymers. 2022; 14(24):5557-5570. IF: 4.967
4. Bitay E, Gergely AL*, Szabó ZI. One-Step Preparation of Fiber-Based Chlorzoxazone Solid Dispersion by Centrifugal Spinning. Polymers. 2023 29; 16(1):123.
5. Bitay E, Gergely AL*, Szabó Z-I. Optimization and Production of Aceclofenac-Loaded Microfiber Solid Dispersion by Centrifugal Spinning. Pharmaceutics. 2023; 15(9):2256. IF: 5.4; https://doi.org/10.3390/pharmaceutics15092256
6. Kántor J., Farmos R.L., Gergely A.L.*, Optimization of Oil Sorbent Thermoplastic Elastomer Microfiber Production by Centrifugal Spinning. Polymers. 2023; 15, 3368. IF: 5.0; https://doi.org/10.3390/polym15163368,
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8. Strnad G, Jakab-Farkas L, Gobber FS, Peter I. Synthesis and Characterization of Nanostructured Oxide Layers on Ti-Nb-Zr-Ta and Ti-Nb-Zr-Fe Biomedical Alloys. Journal of Functional Biomaterials. 2023 Mar 24;14(4):180.
9. Zold EL, Koreh B, Jakab-Farkas L, Domokos E. Analysis of pollen in" handmade" honey samples from the central microregion of Romania by scanning electron microscopy. In PLANTA MEDICA 2023 Nov 1 (Vol. 89, No. 14, pp. 1401-1401). RUDIGERSTR 14, D-70469 STUTTGART, GERMANY: GEORG THIEME VERLAG KG.
10. Bardocz-Veres, Zs.; Miklós, M. L.; Biró, E.-K.; Kántor, E.-A.; Kántor, J.; Dudás, Cs.; Kerekes-Máthé, B. New Perspectives in Overcoming Bulk-Fill Composite Polymerization Shrinkage: The Impact of Curing Mode and Layering. Dentistry Journal 2024, 12(6), 171.
11. Székely-Szentmiklósi I, Rédai EM, Kovács B, Gergely AL, Albert C, Szabó ZI, Székely-Szentmiklósi B, Sipos E. Investigation of Yarrow Essential Oil Composition and Microencapsulation by Complex Coacervation Technology. Applied Sciences. 2024; 14(17):7867.

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14. Székely-Szentmiklósi, I., Rédai, E.M., Vlad, R.A., Szabó, Z., Kovács, B., Gergely, A.L., Albert, C., Székely-Szentmiklósi, B. And Sipos, E.. Microencapsulation of Salvia Officinalis L. Essential Oil by Complex Coacervation Technology. Studia Universitatis Babes-Bolyai, Chemia, 69(3): 2024.
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22. 22. Enikő Bitay, Gergő Tóth, Zoltán-István Szabó: Preparation and Characterization of Fenofibric Acid-Loaded Electrospun Fibrous Mats. Nanomaterials.ISSN: 2079-4991,2026. 16(17), 1111. Q1, IF= 4.3. https://doi.org/10.3390/nano16171111