



POLISH NATIONAL AGENCY
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PROGRAMME

<p>name of the unit:</p> <p style="text-align: center;">DEPARTMENT OF ENVIRONMENTAL ENGINEERING</p> <p style="text-align: center;">Lodz University of Technology</p>		<p>symbol:</p> <p style="text-align: center;">K-95</p> <p style="text-align: center;">http://www.wipos.p.lodz.pl</p>
<p>head of the unit:</p> <p style="text-align: center;">Prof. Ireneusz Zbiciński PhD, DSc</p>	<p>potential promoters:</p> <p style="text-align: center;">Prof. Ireneusz Zbiciński, PhD, DSc Paweł Wawrzyniak, PhD, DSc, TUL Prof. Dariusz Heim, PhD, DSc, TUL Prof. Dorota Brzezińska, PhD, DSc, TUL Prof Maciej Jaskulski, PhD, DSc,</p>	<p>contact person:</p> <p style="text-align: center;">Paweł Wawrzyniak, PhD, DSc, TUL Prof. Phone 48 42 6313724 pawel.wawrzyniak@p.lodz.pl</p>
<p>scope of activities:</p> <ul style="list-style-type: none"> • long-term investigation of building integrated photovoltaics (BIPV), development of composite materials for efficient storage of solar energy on a building scale, • analysis of the effectiveness of fire and emergency ventilation systems for buildings threatened with fire or release of flammable and explosive gases • LCA analysis of the environmental load (including health & safety impacts) • tissue engineering, research on biomaterials (i.e. implants / scaffolds) for the regeneration of the central and peripheral nervous system • theoretical and experimental research of droplets agglomeration spray drying • CO2 absorption in rotary packed bed (RPB) 		<p>graphic material</p>  <p style="text-align: center;">PV Facade</p>  <p style="text-align: center;">Release of flammable gases</p>  <p style="text-align: center;">Pilot plant spray tower</p>
<p>present activities:</p> <p>We developed experimental photovoltaic facades for long-term measurements. The unique feature of the proposed BIPV is the direct integration of flexible photovoltaics with the external thermal insulation composite system (En-ActivETICS). We carry out numerical and experimental tests toward system optimisation and higher power production and thermal stabilisation. We perform CFD simulations of the smoke control and accidental ventilation systems in buildings endangered by fire or the release of flammable and explosive gases. We determine parameters of the ventilation systems for safety evacuation of people in a case of fire. We research regeneration of the central and peripheral nervous system with the use of biomaterials for controlled release of biologically active substances responsible for activating the restoration of anatomical connectivity of damaged axons.</p> <p>We carry out advanced theoretical and experimental LDA/PDA analysis of gas and droplet/particle flow in spray drying including multi nozzle atomization. We run extensive LCA analysis for High Concentrated PV panels and Fibre Composite Manufacturing Technologies in Shipyards. We research absorption of CO2 in rotary packed bed system.</p>		
<p>Future activities:</p> <p>Long-term tests in real environment, development of numerical models for description of fire spread, advanced analysis of dispersed phase flow in spray drying, LCA analysis, in vitro model for 3D cultivation of nerve cells</p>		



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Publications/patents, awards, projects:

- Heim, D., Knera, D.,: A novel photometric method for the determination of reflected solar irradiance in the built environment. *Renewable & Sustainable Energy Reviews*, 2021, vol. 137, 1-14.
- Sobulska M., Zbiciński I.,: *Flame Spray Drying. Equipment, Mechanism and Perspectives*. Boca Raton, FL: CRC Press - Taylor&Francis Group, 2021, 158 pp.
- Brzezińska, D.,: Hydrogen dispersion phenomenon in nominally closed spaces. *Int. J. of Hydrogen Energy*, 2021, vol. 46, no. 55, p. 28358-28365,
- Nawrotek K., Grams J. (2021) Understanding Electrodeposition of Chitosan–Hydroxyapatite Structures for Regeneration of Tubular-Shaped Tissues and Organs. *Materials*, 14(5), 1288; <https://doi.org/10.3390/ma14051288>
- Umana, M., Wawrzyniak P., Rosello C., Llavata B., Simal, S.: Evaluation of the addition of artichoke by-products to O/W emulsions for oil microencapsulation by spray drying. *LWT-Food Science and Technology*, 2021, vol. 151, 1-12,

We run 4 international research projects: in Horizon 2020: Fiber4Yards, 2021-2023 and Hiperion, 2019-2023, IFPRI 2021-2023, En-ActivETICS, M-ERA.NET, 2019-2022, and 6 domestic projects, e.g Implants controlling DNA demethylation intended for regeneration of peripheral nervous system, NSC of Poland, Grant NCN 2017/26/D/ST8/00196, Analysis of the mechanism of particle agglomeration in counter current spray drying with fines return" 2022 –2025, NSC of Poland, Opus 20 LAP, etc

Keywords:

Solar energy, photovoltaic, phase change materials, tissue engineering, fire spread, spray drying, agglomeration, LCA, RPB

List of internship proposal in this research team:

Modelling of heat transfer in an active building component, biomaterials for the regeneration of the peripheral nervous system, LCA analysis, smoke control and accidental ventilation systems, agglomeration in spray drying, absorption in rotary packed bed