



POLISH NATIONAL AGENCY
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| <p>name of the unit:</p> <p style="text-align: center;">DIVISION OF BUILDING MATERIALS, Department of Building Materials Physics and Sustainable Design , Lodz University of Technology</p> | | <p>symbol:</p> <p style="text-align: center;">K-62</p> |
| <p>head of the unit:</p> <p style="text-align: center;">Marcin Koniorczyk</p> | <p>potential promoters:</p> <p style="text-align: center;">Marcin Koniorczyk, Dalia Bednarska, Alicja Wieczorek, Piotr Konca</p> | <p>contact person:</p> <p style="text-align: center;">Marcin Koniorczyk</p> |
| <p>scope of activities:</p> <p>Engineering of building materials including cement-based materials, ceramics, wood, processed wood as glulam, CLT, materials for thermal insulation, ETICS.</p> <p>Determination of main mechanical and physical properties of building materials including compressive and tensile strength, modulus of rupture, diffusivity, water absorption, thermal conductivity, and properties related to durability of cement-based materials such as frost resistance, carbonation. Further, we developed our new methodology for testing the durability of materials under loading.</p> <p>The certified laboratory is designed to deliver the service to the industry partners concerning the standard tests dedicated to various components of external thermal insulation composite systems.</p> <p>The modification of existing materials and invention of new based on the recycling materials lies within the scope of our activity.</p> | | <p>graphic material</p> |
| <p>present activities:</p> <p>The present activities are mainly dedicated to the durability of materials. The corrosion processes of cement-based materials under load are presently investigated. We focus on the following topics: frost resistance of concrete, the introduction of chemical admixture in order to improve the frost resistance, the application of internal hydrophobization as the alternative to the surface one, the carbonation of concrete. The combinations of aggressive environments are also considered, the new testing procedures are developed and tested to solve this problem.</p> <p>The mechanism of salt crystallization within bricks and plasters is also investigated. We develop new testing procedure to investigate the dominant mechanisms behind salt crystallization in ceramic materials. The aggressive potentials of various salts are tested.</p> <p>The new materials are being invented. We focused on the recycling of personal protection equipment used during the coronavirus pandemic. The procedure includes the disinfection and transformation of the equipment to the form, which can be added into concrete mixture. Attention is also focused on the pervious concrete used to build pavements and bicycle roads can be helpful in the correct maintenance of the infrastructure.</p> <p>Further the application of stochastic methods in designing and modelling of building materials is being explored.</p> | | |



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Future activities:

Optimization of personal protection equipment recycling process parameters, Hydrophobization of pervious concrete, Investigation of thermodynamic properties of in-pore liquid confined within cement matrix.

Publications:

1. Marcin Koniorczyk, Salt Transport and Crystallization in Non-Isothermal Partially Saturated Porous Materials Considering Ion Interaction Model, *International Journal of Heat and Mass Transfer*, 2012, 55 (4), 665-679.
2. Marcin Koniorczyk, Dariusz Gawin, Modelling of salt crystallization in building materials with microstructure – Poromechanical approach, *Construction and Building Materials*, 2012, 36: 860–873.
3. Marcin Koniorczyk, Dalia Bednarska, Magdalena Nowosielska, Jacek Rynkowski. 2018. „Nucleation model for mesopore-confined water freezing kinetics”. *International Journal of Heat and Mass Transfer* 120: 575-586. ISSN: 0017-9310.
4. Dalia Bednarska, Marcin Koniorczyk 2020. „ Freezing of partly saturated cementitious materials – Insight into properties of pore confined solution and microstructure”. *Construction and Building Materials* Vol. 251, 10 August 2020, 118895.
5. Marcin Koniorczyk, Witold Grymin, Marcin Zygmunt, Dariusz Gawin, 2021. „Novel stochastic approach to predict the energy demand and thermal comfort in the office buildings considering materials and human-related Gaussian uncertainties”. *Journal of Building Engineering*, Vol. 42 October 2021, 102831
6. Marek Jabłoński, Dalia Bednarska, Witold Grymin, Alessandro Schiavi, Marcin Koniorczyk 2021. „Prediction for the acoustic performance of a floating floor: Novel probabilistic approach considering materials Gaussian uncertainties”, *Applied Acoustics*, Vol. 182. November 2021, 108252

Patents:

International patent application concerning an usage of recycled medical wastes as an addition concrete.

Projects:

National grant PRELUDIUM of National Science Center – Poland, No. 2019/33/N/ST8/00981 "Experimental analysis and modelling of phase transition of water and aqueous solution confined in porous body with regard to durability of building materials" realized at the Lodz University of Technology in years 2020-2023.

Project NAWA: PPN/BCZ/2019/1/00022/RC/00001, Salt transport and crystallization in renovation plasters - integrated eksperimental and numerical analysis

Keywords:

Durability, cement-based materials, porous building materials, salt crystallization, hydrophobization

List of internship proposal in this research team:

Durability of porous building materials, novel experimental procedure to assess the influence of the combined aggressive environment on the corrosion of cement based materials.

Application of stochastic method in the prediction of service life of building elements.

Application of recycling materials toward the development of sustainable materials.