SUMMARY OF THE PUBLICATIONS

OF ASSOC. PROF. ENG. ROSITSA PETKOVA-SLIPETS, PhD

for participation in the competition for the academic position of "**Professor**" in

Field of Higher Education: 5. Technical Sciences

Professional field: 5.7. Architecture, Civil Engineering and Geodesy

at the Department of Construction of Buildings and Facilities of the Faculty of Architecture

of VFU "Chernorizets Hrabar", published in the State Gazette, No. 69 of 31.07.2026

My research interests are related to the structure formation and phase stability of metallic and non-metallic materials, new building and thermal insulation materials, energy efficiency, modern methods for testing and examination of materials (destructive and non-destructive testing), special metallography and electron microscopy.

My scientific papers (See 9. LIST OF SCIENTIFIC PUBLICATIONS) have been published in refereed and specialized scientific journals in Bulgaria and abroad in Bulgarian and English.

For participation in the competition for the academic position of "Professor" I present **1 habilitation work** (monograph), **23 scientific papers** (12 articles in Scopus, of which 1 in Q1, 1 in Q2, 4 in Q3; 6 publications in NRC-NACID journals and 5 scientific publications in other scientific journals with scientific peer review) and **2 textbooks**. All my scientific works are in the field of materials science, metal materials and building materials. The focus of my research is the structure, mechanical and thermophysical properties of environmentally friendly materials, lightweight concrete, syntactic foams, steels, aluminum alloys, etc.

I have participated with reports in national and international scientific forums (see 13. SUMMURY OF RESEARCH ACTIVITIES).

The papers I submit for participation in the competition reflect my specific scientific interests in the field of materials science. The subject of summary are the publications submitted for application in this competition, which have not been used in previous procedures.

I. Monograph

PETKOVA-SLIPETS, R., 2026. *Structure of materials: hierarchical levels, research methods, relationship with properties*. Varna: VFU "Chernorizets Hrabar", 2026. ISBN: 978-954-715-818-4.

Reviewers: Acad. Eng. Yatchko Ivanov, DSc; Prof. Eng. Nikolay Tonchev, DSc

The monograph is structured in five chapters with a total volume of 164 pages. The bibliographic reference is from 259 bibliographic sources, of which 166 have been published since 2000, including 61 in the last 5 years.

The monograph examines basic concepts related to the structure of materials, the methods for its study and its influence on properties. The presentation consistently presents macro-, micro-, nano- and atomic structure. Scientific and applied information on modern methods for studying the structure at different levels is analyzed and systematized. Information on the main structural components of iron-based alloys and concrete is presented. A systematized overview of the methods of structural research is made, which shows that in order to obtain reliable and reliable

scientific results, respectively. characteristics of materials, precise selection and combination of complementary techniques are required.

Numerous examples from the author's research and expert practice are presented with an interpretation of the relevant results. The aim is to build an understanding of the role of structure in the formation of the properties and behaviour of materials, as well as to highlight the importance of structural analysis for engineering practice, research and development of new materials.

The scope of the research is deliberately limited. Of the building materials, only iron-carbon alloys and cement concrete are examined in detail, as they are the basis of the author's research and expert practice. They are considered in the unified logic of the relationship "structure - properties". This point of view allows the structure to be used as a diagnostic element, i.e. it shows not only how the material is built, but gives information about the method of production, about the expected performance indicators and its stability.

The study of the structure of materials is a fundamental basis of modern materials science, as it allows to reveal the relationship between the structure of the substance and its physical, mechanical, chemical and technological properties, which are directly related to their suitability for operation. Each material has a hierarchical organization - from the arrangement of atoms, through the type, size and orientation of the phases to the macroscopically observable features (pores, inclusions, etc.). The interaction between these levels is the basis of the general behavior of the material as an engineering system, which manifests itself under force load, heating, cooling, corrosion and other operating conditions.

A special place is given to the structure - properties relationship. Structure can explain why materials with a similar chemical composition can exhibit different properties depending on the method of production, heat treatment, degree of deformation or hardening conditions. Knowledge of structural features makes it possible to purposefully design materials with predetermined characteristics - high strength, hardness, plasticity, wear resistance, corrosion resistance, thermal and electrical conductivity or durability. That is why structure analysis has been brought out as a necessary stage, both in scientific research and in quality control in production. Modern material research usually requires a combination of several methods in order to obtain a complete and reliable characteristic.

The monograph builds an interpretive framework in which the observed macro- and microstructural features are associated with the causes of their occurrence and with possible scenarios for operational behavior. The goal is to move from description to engineering interpretation.

The monograph aims to show that structural analysis is a bridge between fundamental materials science and real engineering practice. Through it, materials are considered not as static products with fixed indicators, but as systems with a history, internal organization and variable operating behavior. It is this understanding that allows for more accurate material selection, more reliable quality control, more substantiated expertise of defects and more targeted development of new materials with increased durability, safety and efficiency.

The monograph creates a methodological basis for both scientific research and expert assessments, as well as for production control, engineering design and sustainable use of material resources.

II. Publications

JIA, Z., Y. WANG, D. HUI, R. PETKOVA-SLIPETS, Z. WANG, 2026. Room-Temperature PANI/SnS2 Chemiresistive Sensor for Real-Time Ammonia Volatilization Monitoring. *Nanotechnology Reviews (Accepted article, in print), ISSN 2191-9089* (**№10.1_1** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

Ammonia (NH_3) volatilization is a major pathway of reactive nitrogen loss, making accurate and real-time NH_3 monitoring essential for improving nitrogen-use efficiency and mitigating environmental impacts. Herein, a room-temperature chemiresistive NH_3 sensor based on a PANI/SnS_2 P–N heterojunction composite was developed for realtime ammonia monitoring. The composite was synthesized via in situ chemical oxidative polymerization and deposited onto flexible Au interdigital electrodes.

Structural characterizations confirmed the successful integration of PANI and SnS_2 and the formation of closely contacted heterojunction interfaces. The optimized heterojunction composition exhibited a response of 959.7% toward 100 ppm NH_3 and a sensitivity of 9.6% ppm^{-1} at room temperature. In addition, the sensor demonstrated good repeatability, long-term stability, and excellent selectivity, with negligible responses to common interfering gases. The enhanced sensing performance was attributed to the synergistic effects of the PANI/SnS_2 heterojunction and the NH3-induced deprotonation of PANI. Soil volatilization and paddy-field experiments further demonstrated the potential of the sensor for real-time NH_3 monitoring under practical conditions.

PETKOVA-SLIPETS R., P. ZLATEVA, D. STANEVA, 2022. Influence of the polyester non-wovens production type on their thermal and flammability properties. *Journal of Engineering and Applied Science,* article number 51. ISSN 2536-9512. DOI: 10.1186/s44147-022-00107-2. (**№10.1_2** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

In recent years, non-wovens have become the main segment of textile production because they can find applications in different areas. Thermal insulation properties, fire resistance, and flexibility make them cost-effective and efficient insulation panels for buildings. This paper aims to study the influence of the production method and surface treatment on the thermophysical characteristics and behavior under direct fire of two polyethylene terephthalate non-woven fabrics. The fibers have been bonded with polyacrylate adhesive or thermal and coated with silicone. Infrared spectroscopy, optical microscopy, and thermal analyses were applied to compare the non-wovens' morphology, composition, and thermal properties. It finds that the non-woven polyester with acrylic additives and adhesive bonding has a higher thermal conductivity value and high flammability with complete combustion. In contrast, thermosetting siliconized polyester materials have limited flammability with limited droplet release. The silicone-based finish protects the polyester fibers leading to self-extinguishing and stopping the complete combustion of the sample.

PETKOVA-SLIPETS, R., P. ZLATEVA, 2019. An Analysis of the Structure and Thermal Conductivity of Hollow Microsphere Filled Syntactic Foams. *Civil and Environmental Engineering*, 15 (1)*, pp. 36-41*. ISSN 1336-5835. DOI: 10.2478/cee-2019-0006. (**№10.1_3** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The influence of types and parameters of hollow microspheres in the composition of syntactic foams on their structure and coefficient of thermal conductivity has been studied. By using structural and thermal analysis it has been found that the volume concentration and the size of the ceramic and glass hollow microspheres have a strong impact on the density and thermophysical properties of the thin syntactic foams coatings. It has been shown that the best heat insulating properties belong to syntactic foam with composition of 60 vol. % ceramic microspheres with particle size of 1 - 40 μm (k = 0.029 W/m·K, R = 0.008 (m^2·K)/W) and with composition of 80 vol. %

glass hollow microspheres with particle size of 9 - 25 μm (k = 0.087 W/m·K, R = 0.008 (m^2·K)/W). The results demonstrate that application of syntactic foams as thin insulating coatings is appropriate and they are an energy efficient material with number of benefits compare with the common thermal insulators.

PETKOVA-SLIPETS, R., K. YORDANOV, P. ZLATEVA, 2020. A Comparative Thermal Analysis of Walls Composed of Traditional and Alternative Building Materials. *Civil and Environmental Engineering*, 16 (2), pp. 388-395. ISSN 1336-5835. DOI: 10.2478/cee-2020-0039. (**№10.1_4** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

This research aims at comparing the thermal performance of walls made from traditional and alternative building materials. The experimental study involves five types of walls which were studied based on perforated ceramic bricks and a mixture of clay, sand with various straw proportions. Specialized software and the finite element method (FEA) were employed for modelling of the thermal processes and their visualization for the different types of walls. A simulation modelling algorithm was developed. The models developed show very good convergence of the results and provide for subsequent design and thermal calculation of constructions made by environmentally friendly materials.

ZLATEVA, P., R. PETKOVA-SLIPETS, K. YORDANOV, 2023. Properties of grey marl bricks with additions of rice husks. *Magazine of Civil Engineering,* 124 (8), article number 12407St. ISSN 2712-8172. DOI: 10.34910/MCE.124.7. (**№10.1_5** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

This article presents the results of experimental research on the impact of environmentally efficient materials developed on the basis of grey marl and sand with the addition of 3 % to 6 % of rice husk on the thermophysical characteristics: coefficient of thermal conductivity, specific heat capacity and thermal diffusivity. The thermal indicators are measured with a device based on the non-stationary method. The purpose of the research is to investigate the impact of a new type of a light natural organic additive material, the husk of rice grains, on the properties of the resulting composite. The task is to develop a new material which is both thermally efficient and eco-friendly. The results of the research show that the addition of rice husks reduces the coefficient of thermal conductivity by 42 %, of the thermal diffusivity by 38 %, and increases the specific heat capacity by 10 % compared to the reference sample.

ZLATEVA, P., K. YORDANOV, R. PETKOVA-SLIPETS, M. IVANOV, 2024. Numerical simulation of double skin facades in winter climates. *Journal of Chemical Technology and Metallurgy*, 59 (6), pp. 1363-1374. ISSN 1314-7471. DOI: 10.59957/jctm.v59.i6.2024.11. (**№10.1_6** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The presented study reveals the analysis of the thermal behaviour of double skin facades (DSF) in winter conditions, using numerical simulation tools. The aim of the study is the development of a 3D simulation model, capable of evaluating the thermal behaviour of the modular elements in the DSF systems. This is an essential requirement in the prediction and visualization of the facade's thermal behaviour in the design stage and in the assessment of the real behaviour of such a facade, when the specified modular elements are changed by the customer.

The presented numerical simulation model aims to adequately reproduce the resulting set of thermal characteristics of the modular elements, to determine with sufficient accuracy their distribution in the real objects, implemented in the models in DSF systems. An algorithm is developed in the study and graphical visualization of three models of double facade systems with and without DSF are analysed under winter conditions, using data from a meteorological station located in North-Eastern Bulgaria. A software product was used to represent the processes of heat

and mass transfer, in which the corresponding boundary and initial conditions were set, based on which the results and analyses were obtained. The use of such numerical modelling is effective enough to predict the expected thermal behaviour of DSF systems. Thus, when selecting a DSF facade system, awareness of the thermal behaviour is ensured, and the financial efficiency of the project is more easily determined. Such a customized approach not only improves the sustainability and efficiency of buildings, but also satisfies the unique preferences and requirements of the customers.

ZLATEVA, P., K. YORDANOV, R. PETKOVA-SLIPETS, 2020. A study of the thermal properties of an alternative straw-containing building materials. *E3S Web of Conferences*, 207, article number 7. ISSN 2555-0403. DOI: 10.1051/e3sconf/202020701004. (**№10.1_7** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

Thermal comfort in buildings is usually achieved through sustainable materials obtained from natural sources, which justifies their use for developing building mixtures. Many natural materials were used as early as in ancient times to build homes that are warm in winter and cool in summer: a mixture of straw, clay and sand is an example of such a material. The objective of this article is to evaluate the effect of a mixture of clay, sand and straw on thermal comfort. For the purposes of this study, several types of sample plates were made from clay and sand mixture by adding different amounts of straw. The experiments were carried out and the thermal conductivity coefficient was determined using the method of infinite flat layer. The results indicate that the combination of different amounts of straw can be considered as good reinforcement of the sand and clay matrix and is characterized by a low thermal conductivity.

Furthermore, 3D modelling was performed using Finite Element Analysis (FEA) software and a predictive model of the thermal behaviour of the samples from the different mixtures was developed. The thermal field distribution and the thermal conductivity coefficient thus determined were compared with the experimental data and showed consistency.

ZLATEVA, P., R. PETKOVA-SLIPETS, K. YANAZOV AND M. TODOROV, 2025. Comparative Analysis of the Thermal Properties of Lightweight Concretes for Energy-Efficient Construction. *6th International Conference on Communications, Information, Electronic and Energy Systems (CIEES)*, article number 46027. ISBN 979-8-3315-0119-8. DOI: 10.1109/CIEES66347.2025.11300017. (**№10.1_8** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

This study presents a comparative analysis of the thermal behavior of a newly developed cellular lightweight concrete (CLC) and a commercially available autoclaved aerated concrete (AAC). The CLC mix was engineered using Portland cement combined with selected chemical admixtures. Thermal conductivity (λ), thermal diffusivity (a), and volumetric heat capacity (c·ρ) were measured to evaluate and compare the two materials. Results show that CLC has slightly higher thermal conductivity (0.1179 W/(m·K)) compared to AAC (0.0906 W/(m·K)), along with greater thermal diffusivity. In contrast, AAC exhibits a significantly higher volumetric heat capacity. All differences between the materials were found to be statistically significant ($p < 0.0001$). Despite its marginally higher conductivity, CLC demonstrates stable thermal performance, low density, and straightforward production, making it a promising option for non-load-bearing or lightly loaded elements in energy-efficient buildings. This work contributes practical insights into the thermal efficiency of lightweight concrete with similar densities and supports informed material selection for sustainable construction applications.

ZLATEVA, P., R. PETKOVA-SLIPETS, N. MILEVA, K. YANAZOV, 2025. Foam Concrete as a Thermal Insulation Building Material. *10th International Conference on Energy Efficiency and Agricultural Engineering (EE&AE)*, article number 46028. ISBN 979-8-3315-1299-6. DOI:

10.1109/EEAE65901.2025.11273569. (**№10.1_9** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

This paper presents a detailed review of foam concrete as a thermal insulation building material, emphasizing its thermophysical performance and potential for sustainable construction. Foam concrete is a lightweight, cellular concrete containing 60–85% closed pores, resulting in bulk densities of 300–1200 kg/m^3. At densities of 300–500 kg/m^3, its thermal conductivity (0.08–0.12 W/(m·K)) is significantly lower than that of fired clay bricks (0.60–0.90 W/(m·K)) and ordinary concrete (1.40–1.60 W/(m·K)), though higher than mineral wool (0.035–0.045 W/(m·K)) and expanded polystyrene (0.030–0.040 W/(m·K)).

The review synthesizes existing research on composition, pore structure, production methods, and the effects of bulk density, porosity, and moisture content on thermal performance. Comparative analysis shows that while foam concrete does not match the λ-values of polymeric or fibrous insulation, it offers additional advantages such as Euroclass A1 fire classification, resistance to biological degradation, reduced embodied energy, and potential for incorporating recycled content. Applications in external and internal walls, roof screeds, and renovation projects are discussed, highlighting its ability to provide both structural capacity and thermal insulation. The findings suggest that optimizing pore size distribution, increasing closed-cell content, and improving moisture resistance could further enhance foam concrete's contribution to modern energy efficiency and environmental targets.

P. ZLATEVA, R. PETKOVA-SLIPETS, N. MILEVA, K. YANAZOV, 2026. Experimental study of lightweight concrete with lightweight aggregates for energy-efficient building applications. *11th International Conference on Energy Efficiency and Agricultural Engineering (EE&AE)* (приета статия). 3-6 November 2026, article number 46027. (**№10.1_10** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

Lightweight concrete has attracted increasing attention due to its potential to improve the thermal performance of buildings while reducing structural weight. This study investigates the influence of lightweight aggregates on the thermal and mechanical properties of concrete. Five concrete mixtures were produced, including one reference mixture and four mixtures containing different amounts of lightweight aggregates. The specimens were tested after 7, 14, and 28 days to determine density, thermal conductivity, volumetric heat capacity, specific heat capacity, thermal diffusivity, and compressive strength.

The results show that increasing the quantity of lightweight aggregates significantly reduces density and thermal conductivity. After 28 days, thermal conductivity decreased from 2.0798 W/m·K for the reference concrete to 0.1808 W/m·K for the lightest mixture, while density decreased from 2255 kg/m^3 to 980 kg/m^3. The reduction in thermal conductivity was accompanied by a decrease in thermal diffusivity, indicating improved resistance to heat transfer. At the same time, compressive strength decreased from 41.2 MPa to 11.0 MPa, demonstrating the expected trade-off between thermal insulation and mechanical performance.

The developed mixtures provide different combinations of thermal and strength characteristics, making them suitable for various applications where improved energy efficiency is required while maintaining adequate structural performance. The obtained results demonstrate the potential of lightweight concrete to improve the energy efficiency of buildings by reducing heat losses through the building envelope while maintaining adequate mechanical performance for structural and non-structural applications.

ZLATEVA, P., R. PETKOVA-SLIPETS, 2026. Thermal Analysis and Combustion Behavior of Polyester Nonwoven Insulation Materials for Energy-Efficient Applications. *E3S Web Conf.*, article number

01002. ISSN 2267-1242. DOI: 10.1051/e3sconf/202672701002. (**№10.1_11** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

This study examines the thermal behavior and combustion performance of polyester nonwoven insulation materials with different structural characteristics. Three samples, differing in density, bonding technology, and fiber composition, were analyzed using thermogravimetric and differential thermal analysis (TG/DTG/DTA) combined with controlled flame exposure tests. The results show that thermal decomposition occurs within 380-460°C. Quantitative combustion indicators, including ignition time, flame duration, and residual mass behavior, were additionally evaluated in order to establish a clearer relationship between thermoanalytical characteristics and actual fire performance.

Sample 1 exhibits a multi-stage degradation process with DTG peaks at 389°C and 423°C, while Samples 2 and 3 show single peaks at 428°C and 429°C, indicating faster and more uniform decomposition. Endothermic effects related to melting are observed at 248–261°C, followed by exothermic reactions associated with oxidative degradation between 361°C and 496°C. Combustion tests confirm that materials with sharper degradation peaks exhibit more intensive burning and faster structural collapse. A clear relationship between thermal analysis and fire behavior is established, supporting the use of thermoanalytical methods for predicting fire performance of insulation materials. The results further demonstrate that bonding technology and structural density significantly influence degradation mechanisms, flame propagation, and structural stability during thermal exposure.

PETKOVA-SLIPETS, R., P. ZLATEVA, K. YANAZOV, 2026. Effective Thermal Diffusivity of Lightweight Concretes for Energy-Efficient Building Applications. *MDPI Engineering Proceedings* (приета статия, под печат). ISSN 2673-4591. (**№10.1_12** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The transient heat transfer in lightweight concrete mixtures under one-sided heating conditions was studied. Five cement-based mixtures were analyzed with different content of lightweight aggregates. The thermal front propagation was evaluated based on temperature–time data, and effective thermal diffusivity was determined. It was concluded that thermal diffusivity decreases from 2.20×10^{-6} m^2/s for the reference specimen to 1.84×10^{-6} m^2/s for the mixture with the highest aggregate content. The effective thermal diffusivity confirms that heat transfer at 40°C follows a diffusion-controlled mechanism. The proposed experimental approach is a practical and reliable method for evaluating transient heat transfer in cement-based materials.

ZLATEVA P., R. PETKOVA-SLIPETS, 2014. Comparative analysis of the results of measurements of the thermal conductivity coefficient of thermal insulation coating AKTERM. *Scientific works of the University of Ruse*, 53 (1.2), pp. 41-46. ISSN 2535-1028 (**№10.1_13** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

In this paper presented a comparative analysis of experimental results obtained in determining the thermal conductivity of the insulating material AKTERM. Measurements were made by the method of infinite flat layer and the modified method of transient plate source.

Heat insulating coating AKTEPM belongs to new energy efficient materials with energy-saving and anti-corrosion effects. It is an acrylic water-based solution, an alternative to conventional decorative coating materials for wall surfaces. It has low heat penetrability due to its low thermal conductivity.

PETKOVA-SLIPETS, R., P. ZLATEVA, V. MANCHEV, T. YANEVA, 2016. Determination of a complex of thermal properties of materials for road surfaces using the modified method of the short-term heat source. *Proceedings of the International Scientific Conference DCB'2016*, pp. 203-211. ISSN 2603-

4255. (**№10.1_14** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The purpose of the study is to determine a complex of thermophysical properties of materials used in road construction using the method of short-term heat source in order to demonstrate the applicability of the method for testing asphalt mixtures. One material is petroleum bitumen, and the other is a new alternative to bitumen. Asphalt concrete based on them has also been studied in order to be able to have specific data on their thermophysical characteristics.

Synthetic acrylic polymer, a substitute for bitumen, has been found to have higher thermal conductivity than petroleum viscous bitumen and better adaptability to environmental temperature changes. Asphalt concrete with synthetic acrylic polymer has a lower thermal conductivity coefficient than petroleum bitumen-based asphalt concrete, but the two asphalt concrete have analogous sensitivity to temperature changes, i.e. very close values of the heat capacity c_p.

PETKOVA-SLIPETS, R., S. O. TERZI, 2018. Autoclaved Aerated Concrete and its Application as Sound Insulation Material. *Proceedings X Jubilee International Scientific Conference „Civil Engineering Design and Construction“ (Science and Practice)*, c. 291-296. ISSN 2603-4255. (**№10.1_15** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

Autoclaved aerated concrete (AAC) is a relatively new generation building lightweight material. Over the years, AAC has proven its properties and has taken place among the good thermal insulation material. The specific structure of AAC and the possibility to impact on the technology of manufacturing are prerequisites in this group of materials for other specific properties such as acoustic and sound insulation properties to be developed.

The present paper discusses the specific requirements to sound insulation materials and how they could be achieved for autoclave worked aerated concrete.

YORDANOVA, J., R. PETKOVA-SLIPETS, 2026. Buildings with close to zero energy consumption – definition, parameters and design principles. *Proceedings of the XIV International Scientific Conference "Design and Construction of Buildings and Facilities", 10-12 September 2026*. ISSN 2603-4255 (**№10.1_16** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

Nearly Zero Energy Buildings (nZEB) are a key component of the European strategy for reducing energy consumption and greenhouse gas emissions in the building sector. The present report analyzes the definition, regulatory framework and main performance indicators of nZEB, including primary energy demand, thermal characteristics of the building envelope and the share of renewable energy sources. The study further examines the fundamental design principles such as passive strategies, high-efficiency building systems and integrated energy approaches. A simplified energy calculation is presented to demonstrate the practical feasibility of achieving nZEB standards under Bulgarian climatic conditions. The results confirm that nZEB buildings represent a realistic and necessary transition toward sustainable construction.

PETKOVA-SLIPETS, R., S. VLAHOV, 2026. New Technologies in Construction: 3D Printing and Its Application in Construction. *Proceedings of the XIV International Scientific Conference "Design and Construction of Buildings and Facilities", 10-12 September 2026*. ISSN 2603-4255 (**№10.1_17** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

This report is focused on the current technological trends in the construction sector as digitalization, automation and integrated processes. Main approaches such as 3D printing, Building Information Modeling (BIM), digital twins, Artificial Intelligence (AI) and their integration with other digital technologies are analyzed. Their application, advantages and limitations are presented, as well as, their impact on the design and implementation of construction sites.

PETKOVA-SLIPETS, R, 2026. Modern Digital Technologies in Construction. *Proceedings of the XIV International Scientific Conference "Design and Construction of Buildings and Facilities", 10-12 September 2026*. ISSN 2603-4255 (**№10.1_18** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The paper examines the current state of digital technologies in construction within the Construction 4.0 framework, which brings together Building Information Modeling (BIM), the Internet of Things (IoT), Artificial Intelligence (AI), digital twins and 3D concrete printing. A technological review of each of the discussed technologies is presented - their essence, architecture, implemented applications worldwide, in Europe and in Bulgaria, regulatory readiness and Technology Readiness Level (TRL). Particular attention is paid to digital twins and 3D concrete printing as the technologies showing the greatest contrast between technological potential and actual industrial deployment. A comparative TRL analysis of all considered technologies is provided, together with specific recommendations to the scientific community, industry and regulators.

PETROV, P., R. RUSEV, Z. DIMITROV, R. PETKOVA, 2001. Structure of the carbonitride layer of 08X18H10 after gas carbonitration in an environment of ammonia and carbon dioxide with the addition of depassivating chlorine-containing compounds. *Collection of scientific papers from the 20th Anniversary Scientific Conference Department of Materials Science and Technology, Technical University of Gabrovo*, pp. 247-252. (**№10.1_19** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

For stainless steel parts, higher mechanical wear resistance of the surface is also required.

The possibility of finding suitable methods for nitrocarburizing by an atmosphere of NH_3 and CO_2 is considered, using the CARBONIT method. The structure of the carbonitride (nitrogen-carbon) surface layer on stainless steel type 08X18H10 (analogue of AISI 304), obtained by complex gas carbonitration, is studied. A comparison of hardness (HV5, HV10, HV0.05) and the thickness of the resulting layer under different variants of the technological process is made in order to determine which mode gives the best results. In conclusion, a thermochemical treatment regime is proposed, which achieves the best combination of indicators.

PETKOVA-SLIPETS, R., 2009. High-temperature brittleness of Al-Mg alloys containing Na. *Mechanical engineering equipment and technologies*, 2, pp.56-60. ISBN: 1312-0859 (**№10.1_20** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The publication presents the results of a study of the high-temperature brittleness of Al-Mg alloys with traces of Na. High-temperature mechanical tests and Auger-electron microscopy were carried out to determine the cause of the loss of plasticity. Intercrystalline fracture of Al-5Mg and Al-8Mg alloys with a low concentration of Na (2 ppm and 160 ppm, respectively) at temperatures above 100 °C was established. An increased concentration of Na and Mg at the grain boundaries was recorded.

PETKOVA-SLIPETS, R., T. V. ZHIDKOVA, S. M. CHEPURNA, 2014. Formation of a zone of tourist activity within the historical area of the city of Kharkov. *International Scientific and Technical Conference Modern Problems of Architecture and Urban Planning in the Context of International Integration*. Kharkiv, pp. 81-83. (**№10.1_21** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

Tourism is one of the most important sectors of the world's economy. For many countries in the world, the tourism industry is of paramount importance and is the main source of income for most of the population. According to the World Tourism Organization [1], only in the period from January to August 2014, the volume of tourist activity reached 781 million. Europe occupies a worthy

place in this process, but, unfortunately, these are mainly indicators for Northern Europe and Southern Mediterranean Europe, in Central and Eastern Europe a drop in demand for tourist trips was recorded. There are many reasons for not fully using the tourist potential, but one of them, in our opinion, is the lack of special zones of tourist activity (trade, catering, recreation, etc.), which must certainly be directly adjacent to places attractive to tourists. The creation of tourist spaces in the historical center of Kharkiv will lead to an increase in the flow of tourists, to attracting investments from large and small businesses, and, as a result, additional income to the city budget.

PETKOVA-SLIPETS, R., P. ZLATEVA, 2020. New generation of thermal insulating materials for improved thermo-technical performance of residential buildings. *Proceedings of the International Scientific and Practical Conference "Trends and Tendencies in the Development of the Construction Industry"*, Kharkiv: KNUMG, pp. 62-67. (**№10.1_22** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The focus of the present paper is to explore the historical development of thermal insulation materials in terms of their types and properties, as an essential prerequisite for achieving thermal comfort and enhancing the quality of life in residential buildings with the smallest possible thickness of the thermal insulation coatings.

The syntactic foams used as thin film thermal insulation coatings have very good thermal insulation properties. The TTC1 thermal conductivity coefficient is λ1=0,0024 W(/m.K), and that of the TTC2 - λ2=0,0060 W/(m.K). The specific thermal capacity values are: for TTC1 c1=1057 J/(kg.K) and for TTC2 c2=988 J/(kg.K).

The comparative analysis of the thermal conductivity coefficient and the specific thermal capacity of the surveyed classical thermal insulation materials and the thin film thermal insulation coatings irrefutably substantiate the TTC extremely low coefficient of thermal conductivity and high specific thermal capacity.

The reviewed innovative thermal insulation materials prove widely applicable to residential buildings, enhancing their energy efficiency through reduced heat losses.

TANKOVA, E., R. PETKOVA-SLIPETS, V. IVANOVA, 2021. Black sea pollution and technologies for making the sea cleaner. *4th International New York conference on evolving trends in interdisciplinary research & practices*, pp. 148-149. ISBN 978-1-955094-03-0. (**№10.1_23** in the folder 10. COPIES OF SCIENTIFIC ARTICLES and 10.1 PAPERS IN SCIENTIFIC JOURNALS)

The Black Sea is one of the most affected seas by excessive nutrient content and organic congestion. The reasons for that are due primarily to the intensive type of agriculture, which is typical with the dramatic increase of production and intensive use of fertilizers. Most affected by the eutrophication is the northwestern part of the Black Sea, where the great rivers -the Danube, the Dnieper and the Dniester flow in after running through vast agricultural areas, industrial centres and large cities. Large amounts of phosphates and nitrates, flowing into the Black Sea in the way described above, prompt the respective response of the marine ecosystem, in the first place, in the form of massive growth of phytoplankton.

Another major pollutant of the Black Sea is marine litter, which is not restricted by international borders and is therefore a global issue. Marine litter can have a substantial impact both on marine life, and on the people, and it can lead to economic problems for the coastal communities involved in the tourism and fishery industries. The marine litter issue is a problem, which will concern the future generations, and, therefore, knowledge, tools and capacity should be provided to the decision-makers of the future – our children.

The present elaboration tackles the topic of circular economy, while focusing on various possibilities for cleaning up marine litter, which could be applied in the Black Sea region. These developments are globally known and are used for making the world ocean cleaner, however, there

are practical and specific solutions proposed for decreasing the litter in the Black Sea basin. An option for cleaning under the SeaBin technology is presented.

III. Textbooks

PETKOVA-SLIPETS, R., 2026. *Building materials (second edition)*. Varna: VFU "Chernorizets Hrabar", 2026. ISBN 978-954-715-814-6.
Reviewers: Prof. Eng. Hristo Skulev, DSc.; Assoc. Prof. Eng. Roumiana Zaharieva, PhD

PETKOVA-SLIPETS, R., 2009. *Building materials (first edition)*. Varna: VFU "Chernorizets Hrabar", 2009. ISBN 978-954-715-703-3.
Reviewer: Assoc. Prof. Eng. Alexsandar Kirov, PhD

The electronic books on *"Building Materials"* have been developed for students from the specialties *Architecture, Construction of Buildings and Facilities, Water Supply and Sewerage* and *Fire and Emergency Safety*. They are written in accordance with the curriculum in this discipline for students from the above-mentioned specialties from VFU "Chernorizets Hrabar", but they can also be used by students from other specialties, universities and specialists.

The textbooks provide basic knowledge of the most widely used materials in the field of construction and architecture. Knowledge about the properties, technologies of production and processing, areas of application and ways to protect building materials from destructive processes will be acquired. The information is illustrated with many figures, diagrams and photographs in order to be more accessible and easy to remember for the reader. It is assumed that users have basic knowledge of fundamental disciplines such as physics, chemistry, mechanics, strength of materials, etc. Some of the topics (e.g. insulation materials) are developed in a version that provides knowledge only about materials and technologies without treating issues such as specific calculations, design of elements, etc., given their detailed study in separate disciplines.

The textbooks have been developed on the basis of classical and more recent specialized literature. A lot of reference information is also available. Photographic material publicly available from the Internet is used.