

Research Bulletin

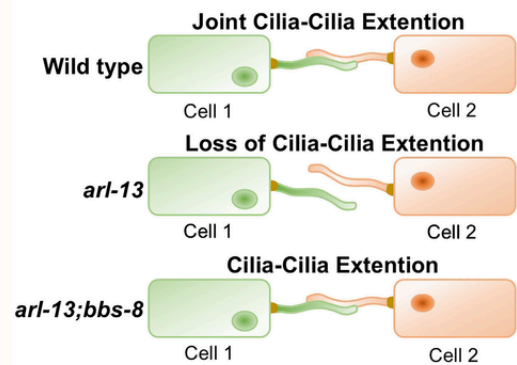
January 2025

A NEW DISCOVERY IN INTERCELLULAR COMMUNICATION: THE REGULATION OF CILIA STRUCTURE ELONGATION

Researchers explored how the fine hair-like structures called cilia extend and interact with each other in intercellular communication. They discovered that the ARL13B protein plays a regulatory role in these structures. Experiments showed that altering specific genes disrupted the orientation of cilia. Additionally, a connection was identified between this process and a cellular mechanism known as the BBSome complex. This research aligns with Sustainable Development Goals (SDGs) 3 (Good Health and Well-being) and 9 (Industry, Innovation, and Infrastructure).



Turan, M. G., Kantarci, H., Cevik, S., & Kaplan, O. I. (2025). ARL13B regulates Juxtaposed Cilia-Cilia Elongation in BBSome dependent manner in *Caenorhabditis elegans*. *iScience*.



A NEW ERA IN SENTIMENT ANALYSIS WITH VISUAL AND TEXTUAL DATA

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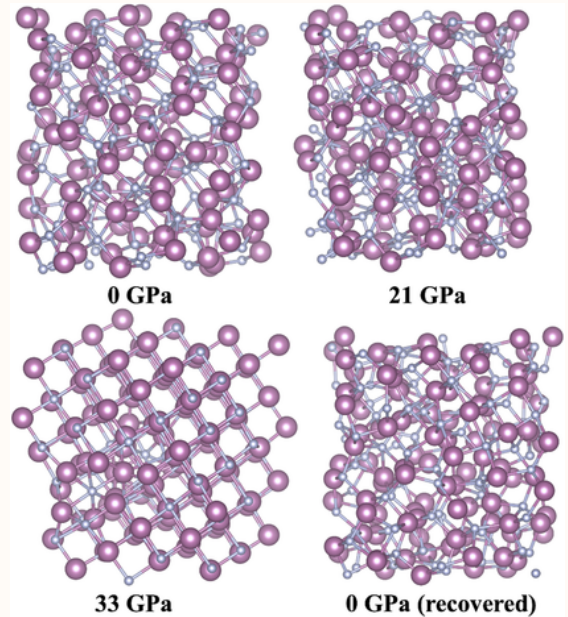
It has been reported that sentiment analysis accuracy increased by 3% by combining facial expressions and written texts. In this study, images and texts were evaluated together to more accurately detect human emotions such as happiness, sadness, and fear. Thanks to this new method, sentiment analysis has become more reliable. This research is related to SDG 9 (Industry, Innovation, and Infrastructure) in terms of developing innovative technologies.

Sungur, K. S. and Bakal, G. (2025). Beyond visual cues: emotion recognition in images with text-aware fusion. *Displays*, 87, 102958. <https://doi.org/10.1016/j.displa.2024.102958>



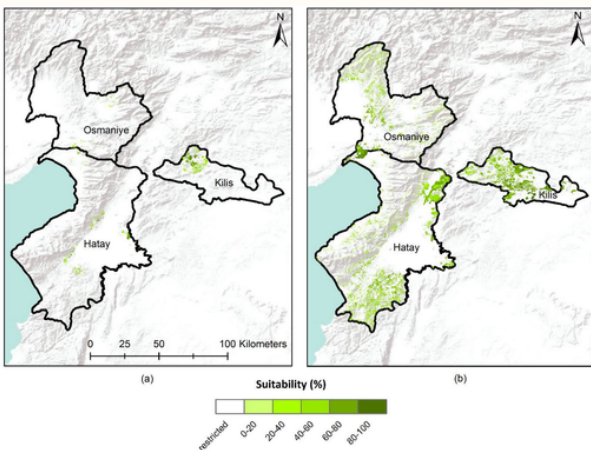
THE BEHAVIOR OF MATERIALS UNDER PRESSURE REDISCOVERED

Researchers investigated how amorphous indium nitride (InN) changes under high pressure. Simulations revealed that when the material reaches a certain pressure, it first transitions from a low-density structure to a high-density amorphous (HDA) phase. With further pressure application, it crystallizes into a rocksalt-like structure. Upon pressure release, the material returns to an amorphous state but retains a higher density than its original form. This research is related to SDG 9 (Industry, Innovation, and Infrastructure) and may contribute to the discovery of new materials for advanced electronic and optoelectronic devices.



Durandurdu, M. (2025). Pressure-driven structural evolution of amorphous InN. *Journal of Non-Crystalline Solids*, 650, 123378.

THE COMBINATION OF SOLAR AND GEOTHERMAL ENERGY FOR CLEANER AND MORE ECONOMICAL ELECTRICITY PRODUCTION EXAMINED



The environmental and economic advantages of systems combining solar and geothermal energy were investigated. A study conducted in the Turkish provinces of Osmaniye, Hatay, and Kilis compared the efficiency of geothermal-solar hybrid systems with battery-supported solar panels. Findings revealed that hybrid systems had lower carbon emissions (44.6 kg CO₂/MWh) and reduced electricity production costs (\$0.091/kWh). However, it was observed that geothermal systems are only feasible in certain regions. This research is considered relevant to SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action).

Fedakar, H. I., Dinçer, A. E., & Demir, A. (2025). Comparative analysis of hybrid geothermal-solar systems and solar PV with battery storage: Site suitability, emissions, and economic performance. *Geothermics*, 125, 103175.



SUSTAINABLE TRANSFORMATION IN OPTOELECTRONIC TECHNOLOGIES

New approaches to enhancing the sustainability of materials used in optoelectronic devices were explored. The study emphasized that environmentally friendly materials can lead to the development of more efficient and durable optoelectronic systems.

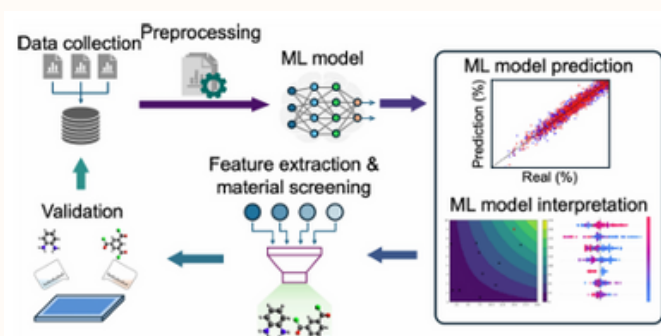


The use of energy-efficient, high-performance materials has been highlighted as a means to reduce carbon emissions in industrial processes. Through innovative solutions, the study aims to minimize the environmental impact of optoelectronic technologies. By aligning with the Sustainable Development Goals (SDG 9: Industry, Innovation, and Infrastructure, and SDG 13: Climate Action), this research contributes to the development of sustainable high-tech applications.



Tiras, K. S., Soheyli, E., Sharifirad, Z., & Mutlugun, E. (2025). Optimization of high efficiency blue emissive n-, s-doped graphene quantum dots. *Optical Materials*, 159, 116544. <https://doi.org/10.1016/j.optmat.2024.116544>

NEXT-GENERATION FILTRATION MATERIALS DISCOVERED WITH ARTIFICIAL INTELLIGENCE



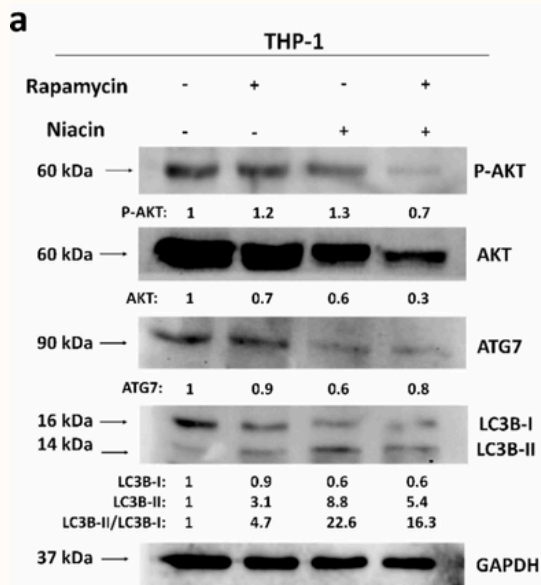
Machine learning accelerated the discovery of new polymer-based filtration materials. While traditional trial-and-error methods were found to be time-consuming and costly, the AI-assisted inverse design approach identified more efficient and durable membrane materials.

In the study, large datasets were analyzed to predict the best-performing polymers, which were then experimentally validated. This innovative approach is considered relevant to SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).

Dangayach, R., Jeong, N., Demirel, E., Uzal, N., Fung, V., & Chen, Y. (2024). Machine learning-aided inverse design and discovery of novel polymeric materials for membrane separation. *Environmental Science & Technology*, 59(2), 993-1012. <https://doi.org/10.1021/acs.est.4c08298>



LEUKEMIA CELL GROWTH INHIBITED WITH NEW COMBINATION THERAPY



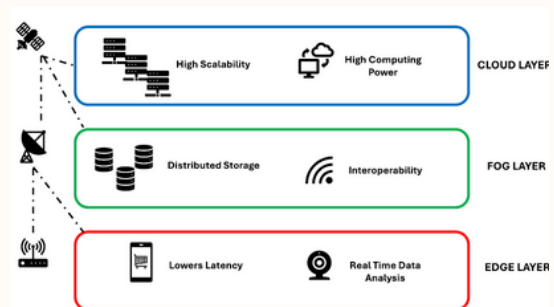
A new treatment approach for acute myeloid leukemia (AML) cells was investigated. The study observed that the combined use of Rapamycin and Niacin significantly reduced cancer cell growth. This combination was found to enhance cell death and arrest the cell cycle. Additionally, the treatment was shown to activate autophagy, a cellular cleansing mechanism. The research is considered relevant to SDG 3 (Good Health and Well-being) and SDG 9 (Industry, Innovation, and Infrastructure).

Subay, L. B., Gencer Akçok, E. B., & Akçok, İ. (2025). Rapamycin and Niacin combination induces apoptosis and cell cycle arrest through autophagy activation on acute myeloid leukemia cells. *Molecular Biology Reports*, 52(1), 75.



EDGE AI: THE INTELLIGENT TECHNOLOGIES OF THE FUTURE

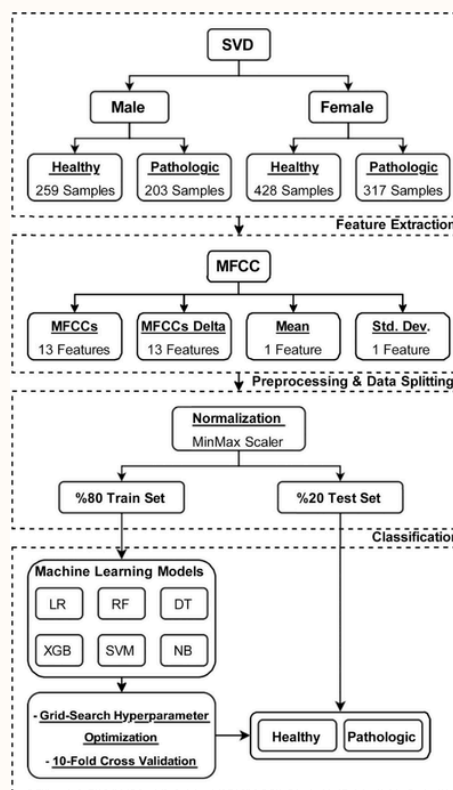
Edge AI technology was explored as a means to accelerate data processing and enhance security. The study demonstrated that by processing data locally on devices instead of transmitting it to cloud systems, faster and more secure analyses can be achieved. Edge AI was highlighted as a technology that can improve efficiency in various fields, including urban security, healthcare systems, and autonomous vehicles. Additionally, it was found to reduce privacy concerns and decrease network data traffic. This research is considered relevant to SDG 9 (Industry, Innovation, and Infrastructure) and SDG 11 (Sustainable Cities and Communities).



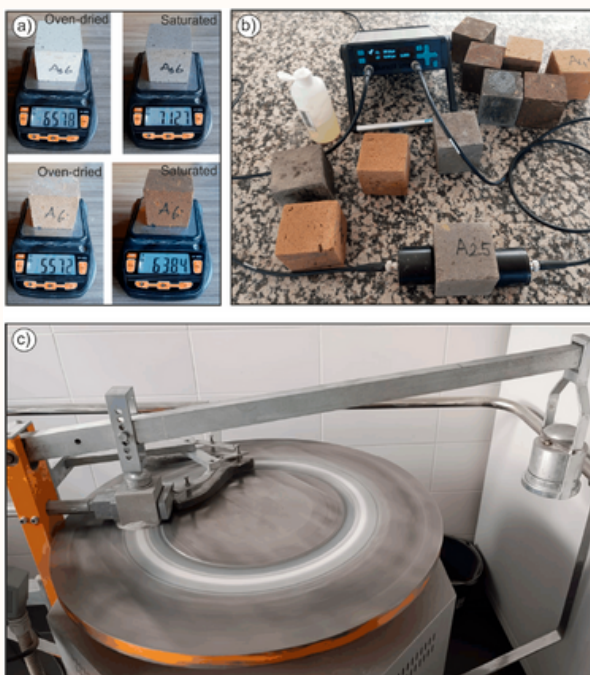
Gill, S. S., Golec, M., Hu, J., Xu, M., Du, J., Wu, H., ... & Uhlig, S. (2025). Edge AI: A taxonomy, systematic review and future directions. *Cluster Computing*, 28(1), 1-53.

EARLY DIAGNOSIS OF VOICE PATHOLOGY MADE EASIER WITH ARTIFICIAL INTELLIGENCE

Artificial intelligence-powered voice analysis methods were examined to improve the early diagnosis of voice pathologies. In the study, healthy and pathological voices were classified using advanced machine learning models. Using recordings from the Saarbrücken Voice Database, the Support Vector Machines (SVM) model achieved the highest accuracy, reaching 99.19% for male voices and 99.50% for female voices. This approach was considered crucial for early diagnosis and more effective treatment processes. The research is associated with SDG 3 (Good Health and Well-being) and SDG 9 (Industry, Innovation, and Infrastructure).



Gulsen, P., Gulsen, A., & Alci, M. (2025). Machine Learning Models With Hyperparameter Optimization for Voice Pathology Classification on Saarbrücken Voice Database. *Journal of Voice*.



WEAR RESISTANCE OF NATURAL STONES DETERMINED THROUGH NON-DESTRUCTIVE TESTING

The wear resistance of natural stones used in Turkey was analyzed using non-destructive testing methods. In the study, AI-based predictive models were developed using data such as water absorption, dry density, and impact wave velocity. Results showed that the Artificial Neural Networks (ANN) model provided the best prediction with 91% accuracy. Additionally, a software tool was developed to allow users to calculate wear resistance. This research is associated with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).

Köken, E. (2024). Development of Comprehensive Predictive Models for Evaluating Böhme Abrasion Value (BAV) of Dimension Stones Using Non-Destructive Testing Methods. *Applied Sciences*, 15(1), 60.



A NEW EDUCATION MODEL DEVELOPED FOR THE SUSTAINABLE FUTURE OF CITIES



Source: Authors' own work

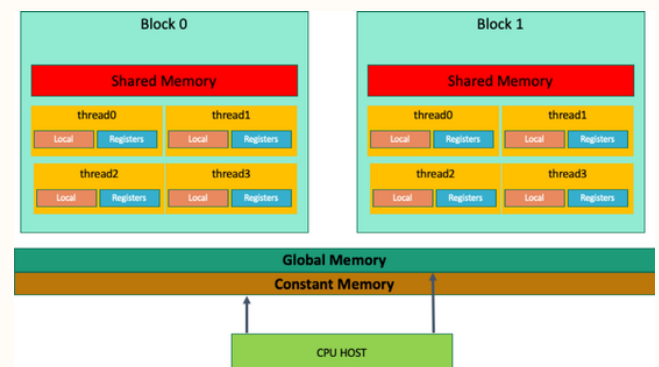
An educational model was developed to enhance university students' awareness of sustainable cities by utilizing urban environments as learning spaces. In the study, students collaborated with experts from various disciplines and conducted fieldwork on urban planning. The results demonstrated that this interdisciplinary approach improved students' critical thinking skills and enabled them to make more informed decisions regarding urban sustainability. The study is associated with SDG 4 (Quality Education) and SDG 11 (Sustainable Cities and Communities).

Kesim, B., & Bengü, E. (2024). Exploring transdisciplinary interaction in higher education: urbanism through informal learning environment. *International Journal of Sustainability in Higher Education*.



GPU PERFORMANCE INCREASED BY 29% THROUGH DATA COMPRESSION

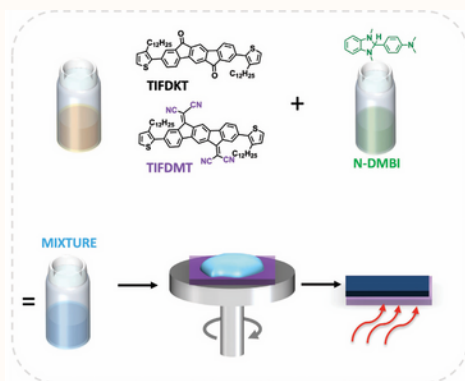
Data compression techniques were utilized to optimize GPU memory usage and accelerate the solution speed of the Traveling Salesman Problem (TSP). The study demonstrated that by compressing city-related data, more points could be stored in the shared memory of the GPU. Three different compression methods were applied, significantly reducing processing time. The developed techniques were found to perform 29% faster compared to standard GPU-based TSP solutions. This research is associated with SDG 9 (Industry, Innovation, and Infrastructure).



Yalcin, S., Usul, H. B., & Yalcin, G. (2024). CompreCity: Accelerating the Travelling Salesman Problem on GPU with data compression. *Integration*, 102333.

WASTE HEAT CONVERTED INTO ELECTRICITY WITH NEW ORGANIC THERMOELECTRIC MATERIALS

Innovative methods to enhance the energy conversion capacity of thermoelectric materials were explored. The study examined the stability and performance of N-type molecular solutions, highlighting their potential as low-cost and environmentally friendly solutions for thermoelectric devices. Findings demonstrated that optimizing material efficiency enables energy generation from waste heat. These results are expected to contribute to energy sustainability and the advancement of renewable energy systems. The research is associated with SDG 7 (Affordable and Clean Energy) and marks a significant step toward the development of eco-friendly energy technologies.

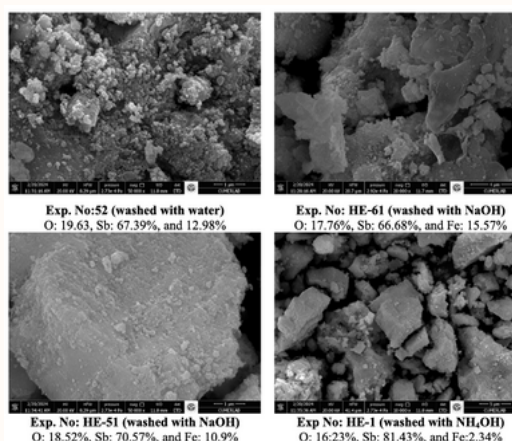


Wang, S., Wei, H., Rillaerts, A., Deneme, İ., Depriester, M., Manikandan, S., ... & Pisula, W. (2024). N-type molecular thermoelectrics based on solution-doped indenofluorene-dimalononitrile: simultaneous enhancement of doping level and molecular order. *Advanced Materials Technologies*, 10(1). <https://doi.org/10.1002/admt.202401131>



A VALUABLE METAL RECOVERED FROM WASTE MATERIALS

A valuable metal, antimony, was recovered from waste materials generated by factories. The study revealed that a special liquid solution was used to separate a large portion of the antimony from the waste. This method resulted in a recovery rate of 91.19% for the metal. Additionally, the recovery of other rare metals from the waste was attempted, but the recovery rate remained below 50%. The research is associated with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).



Ibrahim Idrees Ibrahim, A., Aboelgamel, M., Kaan Soylu, K., Top, S., Kursunoglu, S., & Altiner, M. (2025). Production of high-grade antimony oxide from smelter slag via leaching and hydrolysis process. *Separation and Purification Technology*, 354, 129355. <https://doi.org/10.1016/j.seppur.2024.129355>

PROACTIVE SOLUTION FOR EFFICIENCY IN HETEROGENEOUS EDGE COMPUTING

A new container management system, ProKube, was developed to run machine learning applications more quickly and at lower costs. This system, which utilizes Kubernetes infrastructure, ensures the efficient migration and scaling of applications. Experiments showed that ProKube reduced service latency by 68% and optimized processing costs. The system was also found to enable faster data processing and energy savings. The research is associated with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).

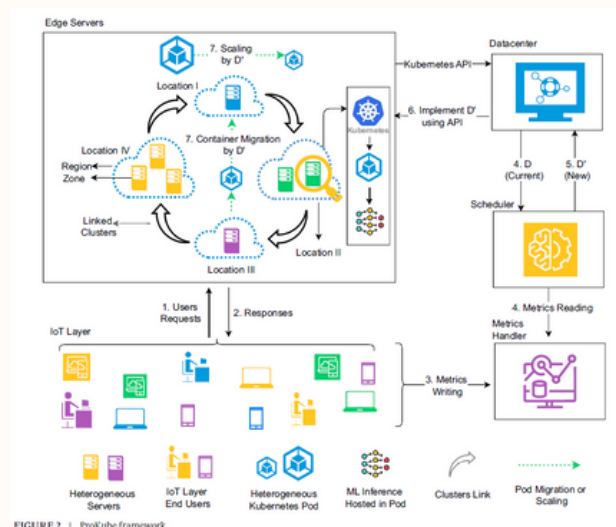


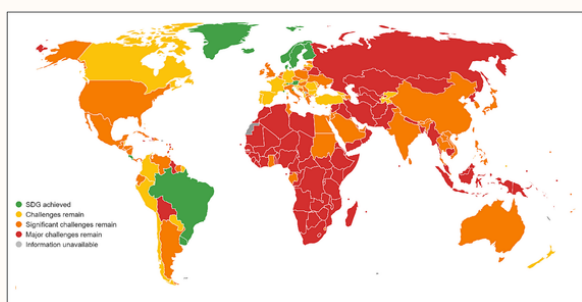
FIGURE 2 | ProKube framework.



Ali, B., Golec, M., Singh Gill, S., Cuadrado, F., & Uhlig, S. (2025). ProKube: Proactive kubernetes orchestrator for inference in heterogeneous edge computing. *International Journal of Network Management*, 35(1), e2298.

TRANSITION TO CLEAN ENERGY ACCELERATED WITH ARTIFICIAL INTELLIGENCE

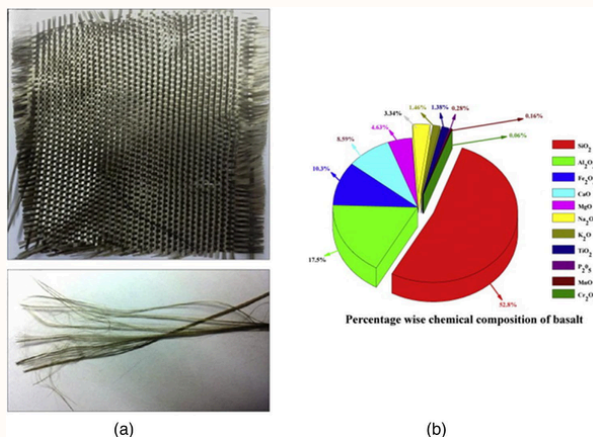
The role of artificial intelligence in energy transformation was investigated. The study examined the impacts of factors such as the Paris Agreement, the Belt and Road Initiative, and green technologies on energy transformation. It was found that AI increases the use of clean energy in both the short and long term, although it can create uncertainties at certain times. The findings suggest that AI-supported policies should be developed to accelerate the transition to green energy. The research is associated with SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action).



Chishti, M. Z., Xia, X., & Dogan, E. (2024). Understanding the effects of artificial intelligence on energy transition: The moderating role of Paris Agreement. *Energy Economics*, 131, 107388.



NEW SOLUTION AGAINST ELECTROMAGNETIC POLLUTION WITH BASALT FIBER-REINFORCED POLYMERS



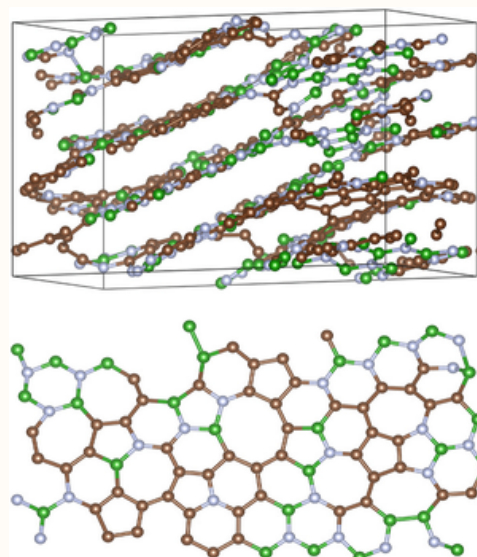
In a study aimed at reducing electromagnetic interference (EMI) pollution, basalt fiber-reinforced polymers (BFRP) were found to offer high mechanical durability and low production costs. The research observed that combining basalt fibers with other conductive materials enhanced EMI protection. Additionally, these materials were highlighted as recyclable and environmentally friendly. The study is associated with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).

Fareez, U. N. M., Loudiy, A., Erkartal, M., & Yilmaz, C. (2024). Basalt Fiber Reinforced Polymers: A Recent Approach to Electromagnetic Interference (EMI) Shielding. *Journal of Polymer Science*.



A NEW SEMICONDUCTOR MATERIAL DISCOVERED: PROPERTIES OF AMORPHOUS BC₂N INVESTIGATED

The atomic structure and properties of a new material called amorphous boron carbide nitride (a-BC₂N) were investigated. The study revealed that this material has a layered structure with boron (B), carbon (C), and nitrogen (N) atoms distributed irregularly. Analyses showed that a-BC₂N is a semiconductor with a narrow band gap and high mechanical strength. These characteristics suggest that it could open new avenues for applications in electronics and materials science. The research is associated with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).



Durandurdu, M. (2025). Atomic Structure and Properties of Amorphous Boron Carbon Nitride (BC₂N): An ab initio Study. *Materials Chemistry and Physics*, 130393.