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# Research Bulletin

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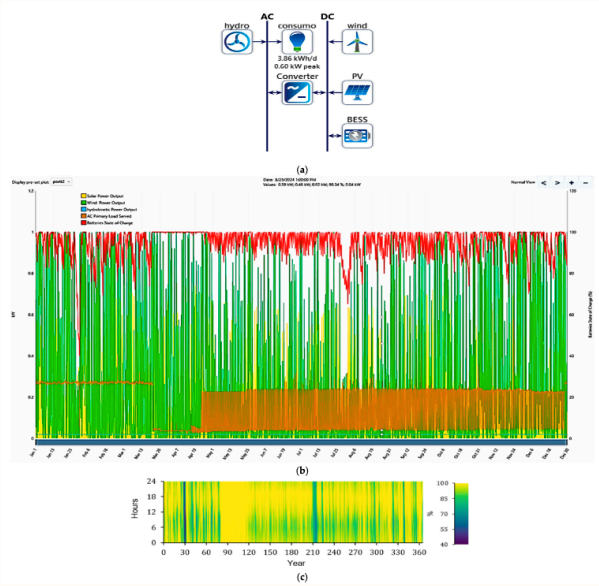
May 2025

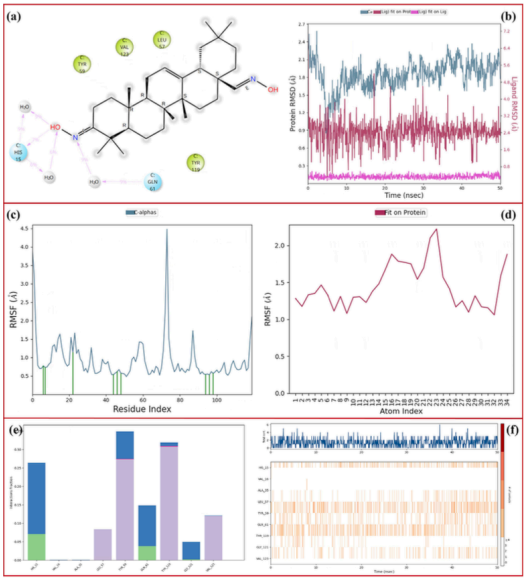
## AI-POWERED ENERGY MANAGEMENT ACCELERATES THE TRANSITION TO CLEAN ENERGY IN PORTS

Aiming to increase energy efficiency in ports, a hybrid energy system combining solar, wind, and water sources was implemented as a pilot project at the Port of Avilés. Under different scenarios, energy management models were developed to accurately predict both energy surplus and deficits. Predictions made using artificial intelligence demonstrated high accuracy. The developed system not only reduced dependency on the electrical grid but also enabled the sale of surplus energy.




Ramos, H. M., Coelho, J. S. T., Bekci, E., Adrover, T. X., Coronado-Hernández, O. E., Perez-Sanchez, M., Koca K., Mcnabola A., Espina-Valdés, R. (2025). Optimization And Machine Learning In Modeling Approaches To Hybrid Energy Balance To Improve Ports' Efficiency. Applied Sciences, 15(9), 5211. https://doi.org/10.3390/app15095211

## A NATURAL HOPE IN THE FIGHT AGAINST ALZHEIMER'S: OLEANOLIC ACID DERIVATIVES STAND OUT

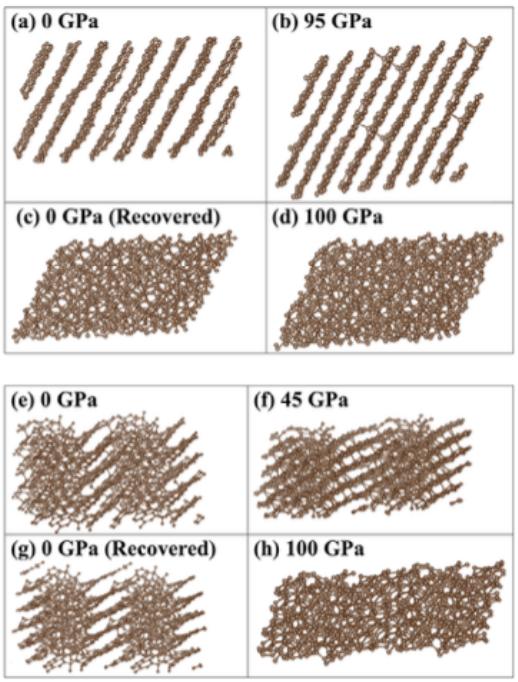



In a study aimed at developing new therapeutic candidates against Alzheimer's disease, nitrogen-containing derivatives of oleanolic acid were found to exhibit strong anti-inflammatory effects. In cell-based experiments, these compounds significantly reduced levels of disease-related proteins and inflammation markers. Computer-aided analyses also revealed that the most effective compound binds strongly to target proteins such as TNF-α and NF-κB. These findings may open promising new avenues for Alzheimer's treatment.

Turgut, G. Ç., Pepe, N., Ekiz, Y. C., Şenol, H., & Şen, A. (2025). Therapeutic Potential Of Nitrogen-Substituted Oleanolic Acid Derivatives In Neuroinflammatory And Cytokine Pathways: Insights From Cell-Based And Computational Models. Chemistry &Amp; Biodiversity. https://doi.org/10.1002/cbdv.202500269

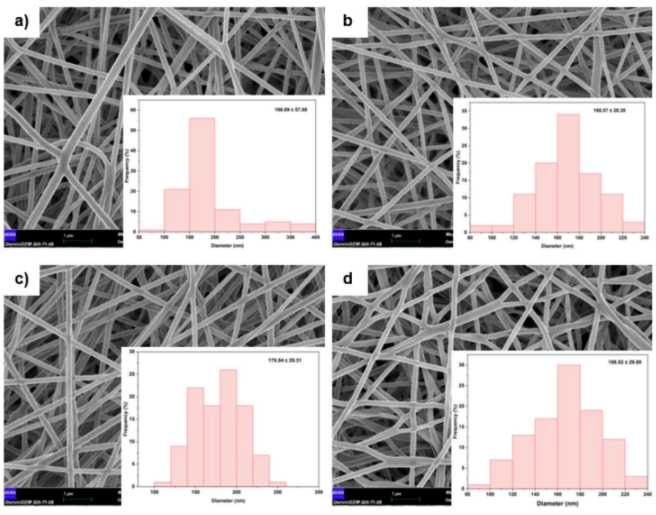
# A NEW CARBON FORM PRODUCED UNDER HIGH PRESSURE: AMORPHOUS DIAMOND

A new structure that could serve as an alternative to diamond—the hardest known form of carbon—has been revealed through computer-aided simulations. In this study, it was shown that a low-density amorphous graphite structure can be rearranged under high pressure into a new tetrahedral form called "amorphous diamond" (a-diamond). During this transformation, significant changes occurred in the bonding structure of carbon atoms, with the $sp^3$ hybridization ratio reaching 97%. The new structure was observed to exhibit mechanical properties such as high density and hardness, comparable to those of crystalline diamond. This research is considered an important step toward the development of durable and processable carbon-based materials.




Durandurdu, M. (2025). Quenchable Amorphous Diamond: A Novel High-Pressure Route To Tetrahedral Amorphous Carbon. Advanced Theory and Simulations. https://doi.org/10.1002/adts.202500015

# NANO COATINGS DEVELOPED FROM POMEGRANATE PEEL HELP MEAT STAY FRESH LONGER

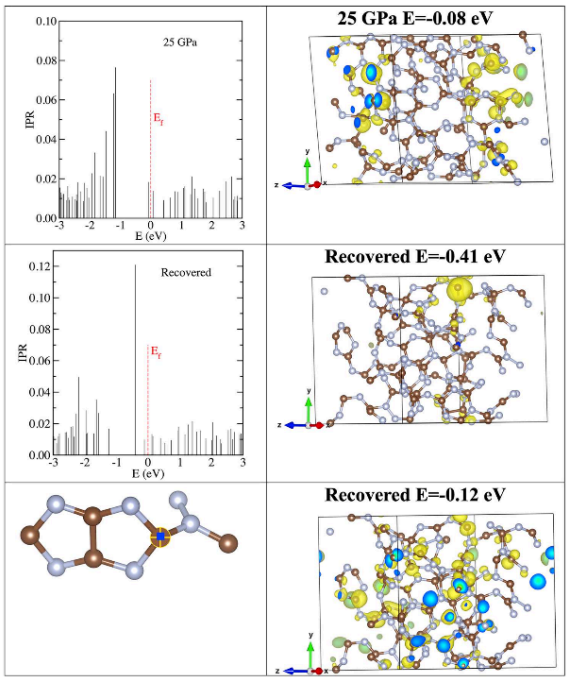



Eco-friendly silver nanoparticles were extracted from pomegranate peel and combined with polyvinyl alcohol (PVA) to create a specialized coating material. These nanofiber coatings were applied to ground meat, and quality changes were monitored over a 9-day period. In samples containing 0.5% and 1% silver, the coatings were found to delay spoilage and reduce microbial growth. Additionally, silver migration remained below the limits set by the European Food Safety Authority (EFSA).

Sari Gencag, B., Kahraman, K., & Ekici, L. (2025). Green Synthesis Of Silver Nanoparticles From Pomegranate Peel And Their Application In Pva-Based Nanofibers For Coating Minced Meat. Scientific Reports, 15(1). https://doi.org/10.1038/s41598-025-95349-4

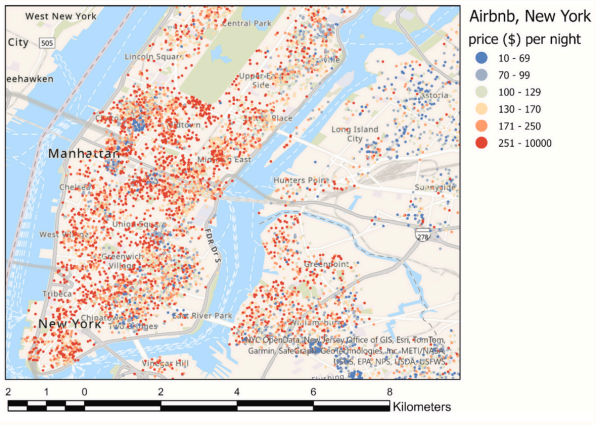
# PRESSURE-INDUCED TRANSFORMATION TURNS CARBON NITRIDE INTO AN IRREVERSIBLE NEW FORM

Amorphous carbon nitride has been shown to undergo a permanent structural and chemical transformation when subjected to high pressure. Initially exhibiting ordered, graphite-like properties, the material loses its chemical order under increasing pressure, leading to the formation of carbon–carbon and nitrogen–nitrogen bonds. The resulting high-density amorphous phase does not revert to its original structure even after the pressure is released. Furthermore, the new structure exhibits n-type semiconductor properties. This transformation is considered a significant advancement in the design of durable, carbon-based materials.




Durandurdu, M. (2025). Irreversible Changes In Amorphous $C_3N_4$ Under Pressure: Loss Of Chemical Order And Graphite-Like Character. High Pressure Research, 1-13. https://doi.org/10.1080/08957959.2025.2496647

# AI REVEALS NEIGHBORHOOD FEATURES THAT INFLUENCE AIRBNB PRICES

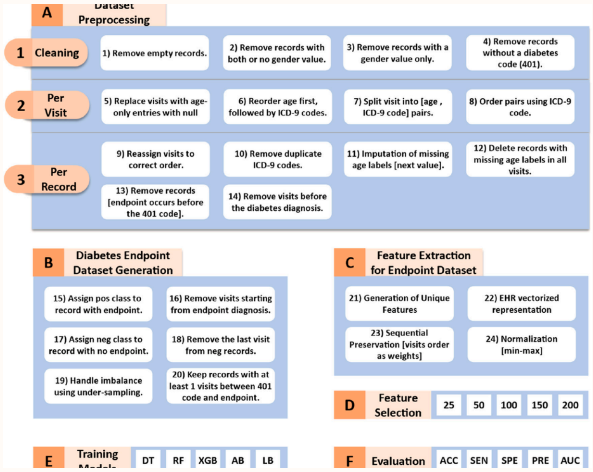



Airbnb listings from eight major U.S. cities were analyzed to investigate whether AI-generated descriptions of neighborhoods affect accommodation prices. The study found that positive terms like “vibrant” and “historic” tend to increase prices, while words such as “ordinary” and “cheap” have a lowering effect. AI-generated content was shown to contribute up to 12% to price prediction models. This research highlights how digital data can enhance our understanding of urban areas and supports the development of new approaches to pricing in the accommodation sector.

Östh, J., Türk, U., Kourtit, K., & Nijkamp, P. (2025). Hedonic Price Models, Social Media Data And Ai – An Application To The Airbnb Sector In Us Cities. Computers, Environment and Urban Systems, 120, 102303. https://doi.org/10.1016/j.compenvurbsys.2025.102303

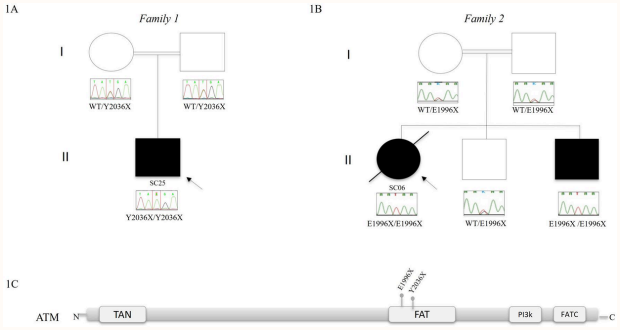
# EARLY PREDICTION METHOD FOR DIABETES COMPLICATIONS DEVELOPED USING SYNTHETIC DATA

A new method has been developed for the early prediction of four major diabetes-related health complications: retinopathy, chronic kidney disease, ischemic heart disease, and amputations. The study utilized nearly one million synthetic patient records and applied machine learning algorithms, achieving accuracy rates between 69% and 77%. The developed models outperformed traditional prediction methods, marking a significant advancement in proactive diabetes care.




Voskergian, D., Bakir-Gungor, B., & Yousef, M. (2025). Engineering Novel Features For Diabetes Complication Prediction Using Synthetic Electronic Health Records. Frontiers in Genetics, 16, 1451290.

# RARE MUTATIONS IN THE ATM GENE REVEAL TRUE DIAGNOSIS IN INFANTS INITIALLY SUSPECTED OF SCID

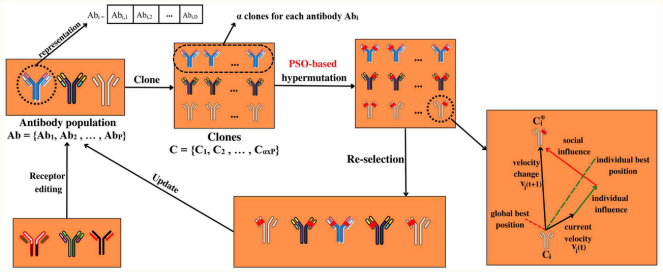



In two infants initially investigated for suspected severe combined immunodeficiency (SCID), early tests were inconclusive. However, advanced genetic analysis identified two distinct nonsense mutations (p.Y2036X and p.E1996X) in the ATM gene. What was initially thought to be SCID was ultimately diagnosed as ataxia-telangiectasia (AT). These findings highlight the critical importance of comprehensive genetic screening for the accurate diagnosis of rare diseases with overlapping symptoms.

Firtina S., Saritas M., Ng Y.Y., Nepesov S., Kiykim A., Bozkurt S., Bilgic-Eltan S., Ng O.H., Sayitoglu M. (2025). Identification Of Nonsense Variants In The ATM Gene Mimicking SCID Phenotype: A Brief Report. Immunologic Research, 73(1), 1-5.

# NEW AI METHOD ENABLES MORE ACCURATE AND FASTER BREAST CANCER DETECTION

A new artificial intelligence model developed for the early detection of breast cancer has drawn attention. Created by combining the Clonal Selection Algorithm and Particle Swarm Optimization methods, the model achieved over 98% accuracy on two different datasets. It is expected to enable faster and more accurate diagnoses. The model's training time was significantly reduced using parallel processing techniques.





Etcil, M., Dedeturk, B. K., Kolukisa, B., Bakir-Gungor, B., & Gungor, V. C. (2025). Breast Cancer Detection Using a New Parallel Hybrid Logistic Regression Model Trained by Particle Swarm Optimization and Clonal Selection Algorithms. Concurrency and Computation: Practice and Experience, 37(12-14), e70107.

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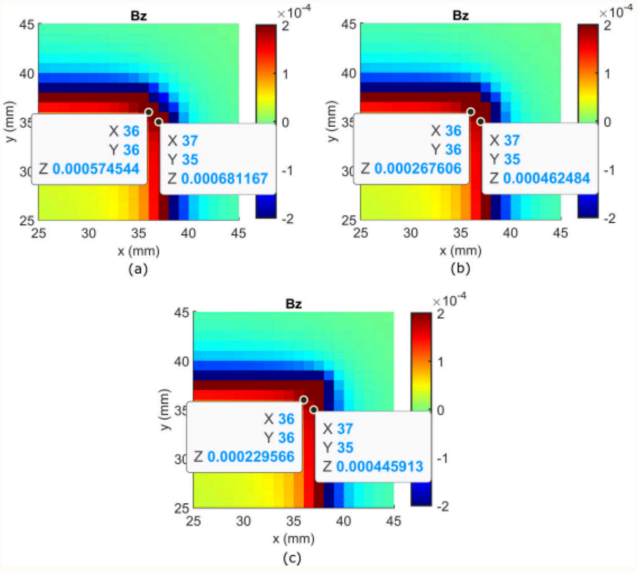


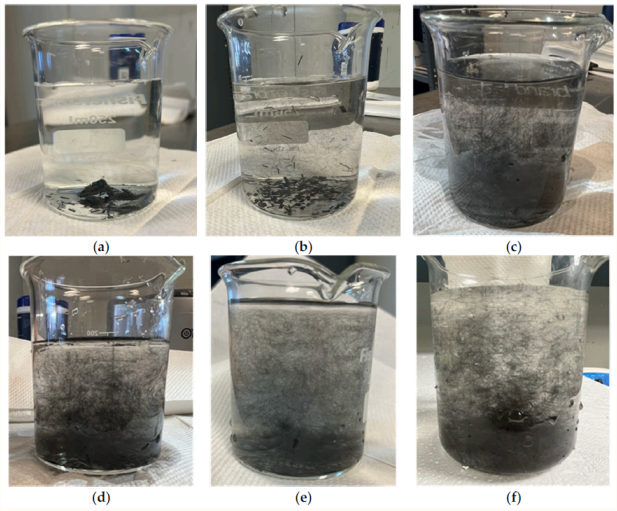

# MAGNETIC FIELD OF ROUNDED-EDGE COILS FULLY CALCULATED FOR THE FIRST TIME

For the first time, the magnetic flux density of planar, single-turn, rounded-rectangle coils has been comprehensively calculated both analytically and experimentally. Using the Biot–Savart law, the study formulated contributions from all edges and corners. The results were validated through finite element method (FEM) simulations and physical measurements. This approach enables accurate and rapid calculations applicable to everyday technologies such as wireless charging and induction cooktops.

Kilic, V. T., & Kavuncu, U. (2025). Semi Analytical Study and Calculation of Magnetic Flux Density Created by Rectangularly Shaped Planar Coils with Rounded Corners. Iranian Journal of Science and Technology, Transactions of Electrical Engineering, 1-21.

# CARBON FIBER WASTE RECYCLED INTO HIGH-PERFORMANCE MATERIALS

In a recent study on the reuse of carbon fiber waste, the recycling process was optimized to achieve both environmental and industrial benefits. Through thermal treatment, fibers were separated without significant damage, and up to 50% of their original strength was retained in new materials. Using the developed method, recycled short carbon fibers were realigned at high density. As a result, the use of recycled materials in high-performance applications such as aerospace has been made possible.




BBalaga U.K., Gunes A., Ozdemir T., Blackwell C., Davis M., Sauerbrunn S., Fuessel L., Deitzel J.M., Heider D. (2025). Optimization of the Recycling Process for Aligned Short Carbon Fiber TuFF Composites. Recycling, 10(2), 55.

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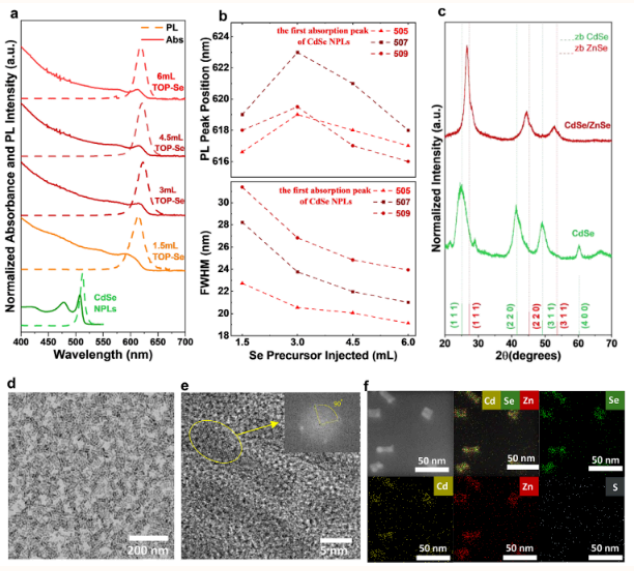
# HIGH-PERFORMANCE QUANTUM WELLS WITH ZINC CHALCOGENIDE-BASED NEW SHELL LAYERS

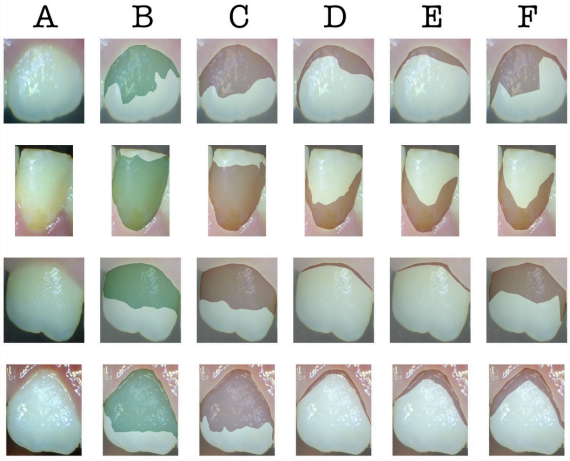



Zinc chalcogenide-based shell layers have been developed to protect colloidal quantum wells arranged in a chain-like structure and to enhance their performance. This structure has significantly improved the stability and efficiency of light-powered devices. The material's design offers a system that can absorb light more efficiently and utilize energy more effectively. This innovative approach enables advancements particularly in solar energy and lighting technologies.

Aldemir, C. H., Yazici, A. F., Ergezer, N., Korkmaz, T. C., Mutlugun, E., & Kelestemur, Y. (2025). Zinc Chalcogenide Based Shell Layers for Colloidal Quantum Wells. Advanced Materials Interfaces, 2500120.

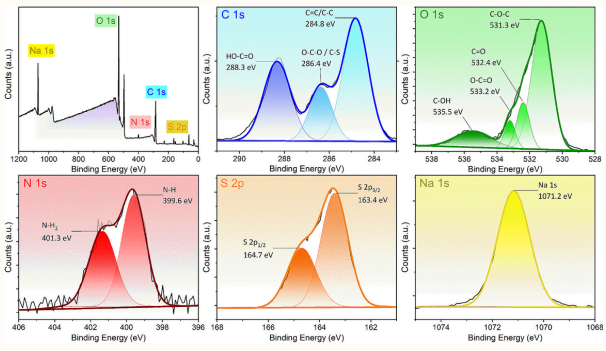
# AI-POWERED MODEL USHERS IN A NEW ERA FOR DENTAL PLAQUE DETECTION IN CHILDREN

An artificial intelligence model capable of detecting dental plaque in the permanent teeth of children aged 8–13 has been developed. The system, which operates through photographic images, was found to produce more accurate results than experienced pediatric dentists. It is suggested that the model could simplify the monitoring of children's oral health and save time during routine dental check-ups. The AI was trained on 506 images and compared against experts using 35 test images.




Tez, B. Ç., Güzel, Y., Kızıltan Eliaçık, B. B., & Aydın, Z. (2025). Deep-Learning-Based AI-Model for Predicting Dental Plaque in the Young Permanent Teeth of Children Aged 8–13 Years. Children, 12(4), 475.


# NEW CARBON DOTS DEVELOPED USING MICROWAVE-ASSISTED SYNTHESIS




Carbon dots (CDs) were successfully synthesized under microwave heating using an innovative method. In the study, white powder CDs were obtained from TSC and TA precursors and characterized using XRD, FT-IR, and XPS analyses. The structure was found to consist of an amorphous outer shell and a weakly crystalline core. Elemental analysis confirmed the presence of carbon (C), oxygen (O), nitrogen (N), and sulfur (S).


Abbas, M., Soheyli, E., Naji, J., Mutlugun, E., Kikhavani, T., & Sahraei, R. (2025). Designed Optimization Of Photoluminescence Emission For Carbon Dots With Bright Blue Emission At 416 Nm And Mono-Exponential Decay Lifetime. Materials Letters, 138615.

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