Science Newsletter

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Contents

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Introduction:

There are 3 main elements in the Science Newsletter which is composed. In the first part, we list the most up to date papers about central issues for each discipline in our university, and they are provided with 5 subjects for a time. In the second part, there are papers from the top journals last month, and most of them are from Nature and Science. In the third part, we post information about calling papers for international conferences. Hopefully, some of the information in this manuscript may be useful for those who are dedicating to scientific career. Besides, the journals are also posted on the website of our library, and they are available to be accessed any time at https://lib.jsut.edu.cn/2025/0228/c5474a193334/page.htm.If there are any questions or suggestions, please send e-mails to ccy@jsut.edu.cn in no hesitate.

Ⅰ Topics

The keywords of this month is **Environmental Enigeering**:
We post several papers which are related to the top concerned topics of researches on Environmental Enigeering. The papers are classified in 5 categories, and they are: **Ecological engineering, Ground water management, Energy Conservation, Biofuels** and **Renewable energy**. Also, the listed papers are all arranged in a descending sort of JCR impact factor. If you want full pages of these papers, please contact us for help.

ECOLOGICAL ENGINEERING

Adv Mater (impact factor: 27.4) 1 区 TOP

All-Polymer Polyethylene-Hydrogel Felt for Efficient Evaporative Cooling and Ecological Restoration in Photovoltaic Power Plants

Zheng, Fu, Ren, et. al

Abstract:
With the explosive growth of photovoltaic (PV) power station, the energy efficiency and ecological impact of which have emerged as two important points of great concern.

In this work, an approach is proposed to cool solar panels and facilitate ecological restoration by engineering moisture cycle in PV plants with an all-polymer hydroscopic felt. Formed by fibers with highly oriented polyethylene (PE) micro-fiber cores and polyacrylamide (PAAm) shells of a few microns in thickness, the felt is ultra-light, anti-corrosive, and demonstrates a high passive heat transfer coefficient of 1100 W m-2 K-1. Under the solar light of one sun, the felt reduces the temperature of solar cells by 28 °C, and increases the output power by 20.4%. Moreover, the felt regenerates to the original state in only 1.3 times the evaporation time. In addition, due to the high evaporation and moisture absorption rate, the PE/hydrogel felt exhibits the ability to raise the ambient humidity in photovoltaic plants by 24% and lower the ambient temperature by 2.6 °C, which significantly promotes the survival rate of surrounding flora. These results show the ability of the all-polymer hydroscopic felt in promoting energy efficiency of PV conversion and offers the potential to augment ecological restoration using PV plants.

J Hazard Mater (impact factor: 12.2) 1 区 TOP

Underestimated roles of phages in biological wastewater treatment systems: Recent advances and challenges.

Huang, Wang, Su, et. al

Abstract:

Bacteriophages (phages) are vital components in biological wastewater ecosystems, whose concentrations are far exceeding those bacteria. Despite their importance, they are often overlooked and regarded as the "dark matter" in biological treatment processes. Phages play a pivotal role in shaping the dynamic evolution of host microbial communities within wastewater treatment plants (WWTPs), driving their functional evolution through interactions with host microorganisms. Phages are crucial in driving microbial ecological dynamics and regulating metabolic functions. At the macroscopic scale, the organic matters released through viral shunting demonstrate enhanced bioavailability and facilitated organic element cycling based on viral shuttle-mediated bio-pump. Additionally, at the micro-scale, gene transfer mediated by phages can assist functional microorganisms in enhancing metabolic efficiency and adapting to environmental stress. However, this process also introduces environmental risks, particularly the dissemination of antibiotic resistance genes through horizontal gene transfer and plasmids. Phages offer distinct advantages over conventional chemical and physical methods, including superior efficiency and environmental sustainability. Nonetheless, the development of phage-based biocontrol strategies is constrained by phage specificity and the complexity of biological treatment systems. Recent advances in artificial intelligence and genetic technologies provide promising avenues for optimizing phage applications. Further research into phage ecology is essential to lay a theoretical foundation for enhancing operational stability, treatment efficiency, and targeted biocontrol strategies.

J Hazard Mater (impact factor: 12.2) 1 ☒ TOP

The nitrate dynamics affected by land use and saltwater intrusion in the coastal hydrologic interaction systems.

Geng, Xiong, Liu, et. al

Abstract:

Nitrate dynamics in the coastal hydrological system is concerned with the impact of nitrate levels on ecological stability and plays an important role in the global nitrogen cycle. However, the complex nitrate source and transport processes in the coastal area and the contribution of nitrogen cycle transformation processes make it a challenge to reveal the nitrate dynamics in the coastal hydrological system. In this study, we investigated the effects of land use types and hydrological interactions on nitrate dynamics in the coastal region using nitrogen composition combined with multi-isotope and Bayesian mixing modeling, focusing on the differences in paleo-saltwater intrusion area (PSIA) and modern seawater intrusion area (MSIA). The results showed that for nitrate sources in PSIA, soil N contributed the highest proportion (45.8% - 77.7%), while the highest proportion is manure and sewage (36.0% - 45.0%) in MSIA. Land use type is the key factor controlling the nitrate dynamics by changing the source and hydrological interaction process. The main source in saline lands is soil N, while manure and sewage are the main source in urban lands. In agricultural lands, nitrate sources are mainly a mixture of fertilizer N, soil N, manure and sewage. Compared with modern seawater intrusion, factors such as deeper burial and strong closure of palaeo-saltwater have led to a slowdown in nitrogen source input, making soil N the main source in PSIA. Nitrification can be promoted within a certain range of TDS in MSIA and can be inhibited when TDS exceeds this range in PSIA. Denitrification was inhibited with elevated TDS in both areas. In addition, nitrification is suppressed in agricultural lands under the influence of palaeo-saltwater intrusion, resulting in lower levels of nitrate pollution than that in MSIA. Nitrate levels here are less related to external inputs and more related to internal nitrate accumulation.

GROUND WATER MANAGEMENT

Chemosphere (impact factor: 8.1) 2 ☒ TOP

Decoding nutrient dynamics in coastal aquifers: Machine learning insights into submarine groundwater discharge and seawater intrusion in south India.

Gopalakrishnan, Srinivasamoorthy, et. al

Abstract:
Coastal aquifers are vulnerable to natural and human-induced processes that impact their resilience and ecosystems. Submarine Groundwater Discharge (SGD) and Seawater Intrusion (SWI) play crucial roles in transporting nutrients and contaminants into coastal waters and threatening coastal aquifers, respectively. This study aims to characterize hydrogeochemical processes governing SGD and SWI using an integrated machine learning (ML) algorithm, overcoming limitations of traditional geochemical methods in analysing complex, nonlinear, and high-dimensional hydrogeochemical datasets. The ML framework, integrating statistical and geochemical analyses, was applied to Ramanathapuram and Rameswaram Island coastal aquifers. Spearman correlation analysis identified key indicators of seawater influence, anthropogenic inputs, redox reactions, dissolution, and ion exchange. Self-Organizing Maps (SOM) and Fuzzy C-Means (FCM) clustering revealed hydrogeochemical patterns in groundwater (GW) and porewater (PW). In GW, Group 1 (27 %) indicated pollution from agricultural NO3-, Group 2 (60 %) represented long-residence freshwater with high DSi and reduced NO3- under clay-layer redox conditions, and Group 3 (13 %) contained high-salinity GW impacted by SWI and saline traps. In PW, Group 1 (11 %) reflected fresh SGD with high DSi and NH4+, Group 2 (68 %) showed SW dominance in intertidal zones, and Group 3 (21 %) represented recirculated SGD enriched in salinity and nutrients due to ion exchange and desorption reactions. Factor analysis clarified hydrogeochemical drivers such as anthropogenic inputs, silicate dissolution, redox reactions, and SW interactions, while ionic ratios (Na/Cl, NO3-/Cl) and delta-analysis geochemically supported these findings. This ML-based approach enhances SGD identification and SWI assessment, offering a novel methodology for coastal aquifer management and ecosystem protection.

Environ Pollut (impact factor: 7.6) 2 区 TOP

Time-Space Patterns of Groundwater Contamination in a Closed MSW Landfill: Insights from Long-Term Monitoring and SOM-Based Clustering Analysis.

Peng, Zhang, Wang, et al

Abstract:
Municipal solid waste (MSW) landfill leachates contain a high load of pollutants, which pose a significant threat to water resources. Evaluating the factors influencing the long-term environmental impacts of MSW landfills, especially the geological and hydrogeological factors, is crucial for the effective risk management of landfill sites. This study investigates the time-space patterns of groundwater contamination at a closed MSW landfill in China, utilizing one and a half years of monitoring datasets and SOM-based clustering analysis. Statistics show Mn (69.49%), NH3-N (68.36%), CODMn (40.68%), Fe (33.33%), Pb (20.90%), and EDC (11.86%) as the primary pollutants with high exceedance ratios. Cl-, TDS, TP, Mn, CODMn, NH3-N, and Fe

show significance ($p < 0.05$) across depth, region, seasons and geological settings, indicating high variations in the environment. Four correlation groups of NH3-N-TDS-Cl--CODMn, Fe-Mn, Pb, and EDC are characterized by SOMs. Site-specific contamination pattern is identified based on SOMs-clustering at locations affected by localized leachate leakage and fault structures. Groundwater contamination patterns at the landfill evolve through distinct seasonal and spatial regimes, driven by the interplay of hydrological dynamics, redox zonation, and geological controls. Temporally, during dry seasons, reduced groundwater dilution amplifies redox-driven processes, leading to localized accumulation of pollutants. Wet seasons homogenize contamination through dilution (only 1 cluster). Spatially, shallow aquifers act as primary receptors for pollutants like NH3-N and CODMn. Deep aquifers accumulate conservative pollutants (Pb, EDC) through vertical migration via faults or deep liner defects. The local leakage of the regulating pool contributes to the lead in shallow groundwater (mean = 0.012 mg/L). The downstream pollution characteristics of groundwater at different depths tend to be consistent under more anaerobic conditions (mean NH3-N = 0.32 mg/L). Our findings demonstrate the SOM-based clustering's utility to analyze long-term monitoring datasets and can be used in related sites.

Ecotoxicol Environ Saf (impact factor: 6.2) 2 ☒

Ecological risk assessment of oilfield soil through the use of machine learning combining with spatial interaction effects.

Wang, Zheng, Tian, et. al

Abstract:

With the intensification of oil extraction activities, total petroleum hydrocarbons (TPHs) and toxic elements contamination in soil around oil wells have become severe environmental problems. This paper proposed a novel method based on machine learning (ML) and remote sensing (RS) to predict concentrations of TPHs and toxic elements in the soil around 1252 oil wells for pollution investigation and monitoring in the Huabei Oilfield in China. RS can obtain variables that are closely related to soil pollution, such as the fractional vegetation cover (FVC), soil type and topographic factors. which can help reveal the pollution driving mechanism combining with ML. ML was used to predict pollutant concentrations, with predictors such as the distribution of oilfield capacity facilities interpreted by RS imagery. Combining RS and ML helps uncover pollution driving mechanisms. The potential ecological risk index (RI) method was utilized to assess ecological risks, and spatial autocorrelation analysis was conducted to determine the spatial distribution characteristics of the pollutants. The results indicated that the Gradient Boosting Machine (GBM) model exhibited strong performance in predicting concentrations of TPHs (R2=0.7730), As (R2=0.8614), Pb (R2=0.8678), Ni (R2=0.7539), Cd (R2=0.7447), and Hg (R2=0.6270) in soil. Oil extraction activities, land use, and soil properties are the dominant factors influencing the accumulation of TPHs and toxic elements. The ecological risk assessment combined

with bivariate LISA mapping identified priority areas for risk control, of which 22.73 % were with no risk, 18.18 % were with combined TPHs and toxic elements risk, 8.67 % were with toxic elements risk, 6.61 % were with TPHs risk, and 26.04 % were with uncertain risk. The results can be applied to provide technical support for soil risk management and industrial site planning in the oilfield and surrounding area.

ENERGY CONSERVATION

Water Res (impact factor: 11.4) 1 区 TOP

Adaptive water management under coal-fired power phase-out: Reshaping of water supply-demand patterns and new equilibrium for cascade reservoir reoperation.

Gou, Ma, Liu, et. al

Abstract:
Decarbonization policy has promoted widespread deployment of clean energy and large-scale water-intensive coal-fired power phase-out (CPP), substantially reducing water demand and creating new opportunities to mitigate water conflicts in water-scarce basins. To manage this transition, the concept of equity inclination degree (EID) is proposed to mitigate allocation disparities, and a two-stage water resources optimization model incorporating EID is developed to assess the broad impact of CPP-induced water conservation on basin water management. The water allocation response coefficient (WARC) is proposed to uncover the adaptive response of water system to CPP, and the associated synergistic benefits under runoff uncertainty are evaluated using exceedance probability curve. The Yellow River Basin case study shows that CPP-induced water conservation is expected to raise the overall water satisfaction rate from 81.8 % in 2020 to 83.8 % by 2035. Additionally, hydropower generation will increase by an average of 0.18 TWh, and the downstream ecological water replenishment will witness an increase of up to 0.302 billion cubic meters in 2035. Runoff uncertainty affects the reservoir operation strategy under CPP, with water released by CPP prioritizing supply for provincial demands in low inflow conditions and shifting to hydropower generation and ecological replenishment in high inflow scenarios. Interprovincial water flow analysis indicates that the water conservation in upstream provinces triggers a favorable cascading effect, significantly enhancing hydropower efficiency. At the policy level, we recommend incorporating the EID into water allocation planning and establishing cross-provincial compensation mechanisms to promote the equitable distribution of cumulative benefits. Moreover, reservoir operation strategies should be adaptively adjusted considering supply-demand

dynamics to maximize CPP-induced synergistic benefits.

Plant Biotechnol J (impact factor: 10.1) 1 ☒ TOP

A visual monitoring DNA-free multi-gene editing system excised via LoxP::FRT/FLP in poplar.

Wu, Chai, Li, et. al

Abstract:

The CRISPR-Cas9 system has emerged as a potent molecular scalpel for precise genome editing, and profoundly revolutionized plant genetics and breeding, facilitating the development of innovative and improved plant varieties. Typically, the CRISPR-Cas9 gene-editing construct is delivered into target organisms via Agrobacterium tumefaciens-mediated transformation or biolistic methods. However, the incorporation of the CRISPR-Cas9 machinery increases the risk of off-target effects, causing unintended genomic alterations. Additionally, the introduction of exogenous DNA sequences, such as antibiotic resistance marker, raises public concerns regarding the biosafety and regulatory oversight of genetically modified organisms (GMOs), potentially hindering regulatory approval and commercialization. Here, we have engineered an integrated system comprising RUBY, LoxP::FRT/FLP and CRISPR/Cas9-sgRNA cassettes within a single construct, allowing visible color monitoring throughout process including genetic transform, positive transgenic and edited events screening, as well as exogenous DNA excision events, we refer to it as 'a visual monitoring DNA-free multi-gene editing system (VMDFGE)'. This system was introduced into poplar through Agrobacterium tumefaciens-mediated transformation, yielding transgenic poplars with a 75.0% visual screening rate, a 45.8% targeted mutation rate and a 54.5% excision rate for the entire integration system. This approach eliminates the concerns associated with off-target effects and GMO regulatory challenges. It offers significant potential for improvement of poplar, other woody plants and crop species while removing the foreign DNA.© 2025 The Author(s). Plant Biotechnology Journal published by Society for Experimental Biology and The Association of Applied Biologists and John Wiley & Sons Ltd.

Sci Total Environ (impact factor: 8.2) 2 ☒ TOP

Long-term conservation tillage and straw return affect thermal stability of soil organic matter.

Filimonenko, Liu, Wang, et. al

Abstract:

The equilibrium between energy persistence and microbial accessibility of soil organic

matter (SOM) determines its contribution to climate mitigation and soil health. Labile SOM maintains the activity of soil microorganisms, which provide nutrients for crops and increase yields. Stable SOM is crucial to long-term carbon (C) storage and sequestration in soils. No-till and subsoiling combined with straw return increase SOM content and stocks, yet their specific impacts on the thermodynamic equilibrium between SOM stability and availability remain unclear. We studied the effects of 22 years of no-till and subsoiling with straw return on SOM thermal stability in loamy Calcaric Cambisols. SOM thermal stability was assessed based on the balance between the energy density (ED) in labile, stable, persistent, and refractory SOM and their activation energy (Ea) for thermal oxidation. The energy properties of SOM were evaluated via differential scanning calorimetry and thermogravimetry of soils from six treatments (3 tillage practices (no-till, subsoiling, and conventional tillage as a control) with 2 straw management practices (straw return and straw removal) at 0-12 cm, 12-30 cm and 30-35 cm depths. Compared with conventional tillage, long-term no-till and subsoiling increased the content and thermal stability of SOM, with these effects being amplified by straw return. Conservation tillage with straw return contrastingly affects SOM pools: 1) Ea of labile SOM decreased by 5 %, increasing energy availability for microorganisms; and 2) Ea of recalcitrant SOM increased by 10 %, which was sixfold higher Ea than thermally labile SOM. Subsoiling preferentially raised the content of energy-rich SOM pools, whereas no-till demonstrated superior efficacy in thermodynamic stabilization of SOM compared to subsoiling. Conservation tillage with straw return increased both highly stable organic C and energy-rich available C. Concluding, conservation tillage (no-till and subsoiling) increased content of available energy in soil via contribution to labile SOM, and intensified C stabilization through increased energetic constraints of persistent SOM. This makes conservation tillage with straw return a promizing strategy for climate-smart soil management.

BIOFUELS

Bioresour Technol (impact factor: 9.7) 1 ☒ TOP

Reprogramming yeast metabolism to Alter fatty acid profiles from even-chain to odd-chain Configuration.

Meng, Ding, Cui, et. al

Abstract

Odd-chain fatty acids have significant applications in biofuels and pharmaceutical industries. In this study, a yeast cell factory was engineered to produce odd-chain fatty acids and their derivatives. The threonine biosynthesis pathway was initially engineered

to enable the de novo synthesis of odd-chain fatty acids, resulting in odd-chain fatty acids accounting for 24.7 % of the total fatty acids. Subsequently, silencing the native fatty acid synthase and introducing a fatty acid synthase from Rhodotorula toruloides, which exhibits higher affinity for propionyl-CoA than the native enzyme, increased the proportion of odd-chain fatty acids to 51.9 %. Further modifications to the lipid metabolism enabled the production of odd-chain free fatty acids (184.1 mg/L) and odd-chain triglycerides (75.2 mg/g). This study successfully shifted the metabolism of Saccharomyces cerevisiae from traditional even-chain fatty acids to a strain dominant in odd-chain fatty acids, demonstrating the potential to develop a novel platform strain for producing specific odd-chain fatty acids derivatives.

New Phytol (impact factor: 8.3) 1 区 TOP

H Local adaptation of both plant and pathogen: an arms-race compromise in switchgrass rust.

VanWallendael, Wijewardana, Bonnette, et. al

Abstract

In coevolving species, parasites locally adapt to host populations as hosts locally adapt to resist parasites. Parasites often outpace host local adaptation since they have rapid life cycles, but host diversity, the strength of selection, and external environmental influence can result in complex outcomes. To better understand local adaptation in host-parasite systems, we examined locally adapted switchgrass (Panicum virgatum), and its leaf rust pathogen (Puccinia novopanici) across a latitudinal range in North America. We grew switchgrass genotypes in 10 replicated multiyear common gardens, measuring rust severity from natural infection in a 'host reciprocal transplant' framework for testing local adaptation. We conducted genome-wide association mapping to identify genetic loci associated with rust severity. Genetically differentiated rust populations were locally adapted to northern and southern switchgrass, despite host local adaptation to environmental conditions in the same regions. Rust resistance was polygenic, and distinct loci were associated with rust severity in the north and south. We narrowed a previously identified large-effect quantitative trait locus for rust severity to a candidate YELLOW STRIPE-LIKE gene and linked numerous other loci to defense-related genes. Overall, our results suggest that both hosts and parasites can be simultaneously locally adapted, especially when parasites impose less selection than other environmental factors.© 2025 The Author(s). New Phytologist © 2025 New Phytologist Foundation.

Int J Biol Macromol (impact factor: 7.7) 2 区

Evaluation on the efficiency of "lignin-first" dissolution and biomass fractionation in alcohols solvents systems.

Xie, Pei, Ni, et. al

Abstract

In this study, wheat straw (WS) was pretreated using sodium hydroxide (NaOH)/sulfuric acid (H2SO4)-catalyzed ethanol, ethylene glycol (EG), and glycerol as solvents. The NaOH-EG pretreatment of WS yielded impressive results with 89.97 % delignification and 79.78 % fermentable sugar yields. Density functional theory analyses revealed that the superior performance of EG originated from its dual hydroxyl groups, which enhanced the molecular polarity index of lignin (15.88 kcal mol-1) than that by ethanol (14.99 kcal mol-1) and also increased the electrostatic potential (+66.23 kcal mol-1). These properties destabilize lignin-carbohydrate complexes while preserving β-O-4 linkages. Experimental validation via Fourier transform infrared spectroscopy and X-ray diffraction confirmed the selective capability of EG for lignin solvation. Simultaneous saccharification and fermentation experiments showed a correlation between theoretical polarity trends and improved ethanol yields. NaOH-EG pretreatment promoted lignin biorefining by achieving higher delignification than H2SO4-EG while reducing β-O-4 cleavage, thus ensuring biofuel viability and lignin valorization. This study integrated experimental biomass fractionation with quantum chemical simulations, bridging macroscale biomass processing with atomic-scale solvent-lignin interactions. It provides a rational framework for solvent selection in biorefining, offering insights into optimizing biomass conversion processes.

RENEWABLE ENERGY

Environ Sci Technol (impact factor: 10.8) 1 区 TOP

Self-Limiting Effects of Global-Scale Desert Solar Farms: Climatic Feedbacks and Constraints on Wind-Solar Energy Synergy.

Zhou, Wu, Wang, et. al

Abstract

This study investigates the self-limiting effects of large-scale solar farms deployed in global desert regions, focusing on their far-reaching climatic and energy system impacts. By integrating a novel surface energy balance model into a global climate model, we simulate the consequences of installing solar farms over 20% of desert areas across five

continents. Our findings reveal significant global and regional climatic feedbacks, including a 6.95% reduction in near-surface wind speeds, which leads to a 5.5% decline in global wind power generation potential (312.47 TW h annually). Furthermore, solar farms induce local atmospheric changes, such as increased surface temperatures and cloud cover, resulting in a 22.44 TW h reduction in solar power output. Crucially, these climatic impacts on surface radiation extend beyond immediate locations, influencing renewable energy resources in distant regions through teleconnections. This self-limiting dynamic underscores the inherent trade-offs between solar and wind energy, highlighting the need for integrated global energy planning that accounts for cross-border climatic and energy interdependencies. Our results emphasize the importance of balancing renewable energy expansion with the resilience of global energy systems, offering critical insights for sustainable energy strategies in a decarbonized future.

Sci Total Environ (impact factor: 8.2) 2 区 TOP

Life cycle assessment of urban pavements: Environmental impact analysis of integrating waste silt in hot mix asphalt.

De Pascale, Lima, Solouki, et. al

Abstract:

Over the past decade, numerous studies have explored the incorporation of recycled aggregates into asphalt concrete to reduce the environmental impacts associated with the production of hot mix asphalt (HMA). Nonetheless, only a limited number of these studies have specifically investigated the substitution of waste silt for limestone fillers. This study seeks to enhance understanding of the environmental implications of using waste silt in asphalt concrete pavement, applying the life cycle assessment (LCA) methodology. The analysis includes both 'cradle-to-gate' and 'cradle-to-grave' approaches to compare the environmental impacts of four different asphalt mixtures: 1) a control mixture with virgin aggregates, 2) a mixture incorporating silt, 3) a mixture with calcinated waste silt, and 4) a mixture with flash calcinated waste silt. The environmental assessment employs the non-renewable cumulative energy demand (nr-CED) and global warming potential (GWP) as primary indicators, spanning a projected lifecycle of 30 years. Furthermore, the ReCiPe midpoint method is utilized to focus on the most critical environmental indicators, including terrestrial, marine, and freshwater ecotoxicity, human carcinogenic and non-carcinogenic toxicity, and land use impacts. Preliminary results indicate that while the recycled mixtures show increased environmental benefits per kilogram of asphalt concrete produced compared to the control mixture during the production phase, the longevity of the control mixture surpasses that of the recycled alternatives over the complete 30-year lifecycle, resulting in lower overall environmental burdens.

J Environ Manage (impact factor: 8) 2 区

Examining A(symmetric) relationship of renewable energy, healthcare expenditures, and export with environmental degradation: Evidence from OECD countries by ARDL approaches.

Kartal, Ayhan, Sarıhan, et. al

Abstract:

Environmental degradation, closely tied to climate change, remains a pressing global challenge that requires comprehensive and multidimensional analysis. Although numerous studies have independently examined the roles of renewable energy, healthcare expenditures, and trade in environmental outcomes, their joint influence remains underexplored-particularly within OECD countries. This study fills this gap by investigating (a)symmetric effects of renewable energy consumption, healthcare expenditures, and exports on environmental degradation for 37 OECD countries from 2000 through 2020. Using the NARDL approach as the primary methodology, complemented by panel ARDL for robustness, the analysis captures both the direction and asymmetry of long run relationships. The results indicate that increases in renewable energy use and healthcare expenditures significantly reduce CO2 emissions, while export growth contributes to higher emissions. Moreover, asymmetric effects are evident: positive and negative shocks in all three variables produce differing magnitudes and directions of impact on environmental outcomes. These findings suggest that fostering renewable energy development can be an effective strategy for directly mitigating environmental degradation. Additionally, the evidence implies that countries may be reducing carbon emissions indirectly to control rising healthcare expenditures associated with pollution-induced health risks. On the other hand, export-driven production must be aligned with sustainable practices.

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Ⅱ Concentration

PHYSICS

Gate-driven band modulation hyperdoping for high-performance p-type 2D semiconductor transistors

Bei Zhao, Zucheng Zhang, et al.

Abstract

Tailoring carrier density in atomically thin two-dimensional (2D) semiconductors is challenging because of the inherently limited physical space for incorporating charge dopants. Here, we report that interlayer charge-transfer doping in type III van der Waals heterostructures can be greatly modulated by an external gate to realize a hyperdoping effect. Systematic gated-Hall measurements revealed that the modulated carrier density is about five times that of the gate capacitive charge, achieving an ultrahigh 2D hole density of 1.49 × 1014 per square centimeter, far exceeding the maximum possible electrostatic doping limit imposed by typical dielectric breakdown. The highly efficient hole-doping enables high-performance p-type 2D transistors with an ultralow contact resistance of ~0.041 kilohm micrometers and a record-high ON-state current density of ~2.30 milliamperes per micrometer.

Differential absorption of circularly polarized light by a centrosymmetric crystal

Katherine A. Parrish, Andrew Salij, et al.

Abstract

Crystalline solids are governed by universal structure-property relationships derived from their crystal symmetry, leading to paradigmatic rules on what properties they can and cannot exhibit. A long-held structure-property relationship is that centrosymmetric crystals cannot differentially absorb circularly polarized light. In this study, we demonstrate the design, synthesis, and characterization of the centrosymmetric material Li2Co3(SeO3)4, which violates this relationship not by defying symmetry-imposed selection rules but by invoking a photophysical process not previously characterized for crystalline solids. This process originates from an interference between linear dichroism and linear birefringence, referred to as LD-LB, and involves strong chiroptical signals that invert upon sample flipping. In addition to enabling a chiroptical response under centrosymmetry, this process opens up photonic engineering opportunities based on crystalline solids.

Visualizing dynamics of charges and strings in (2 + 1)D lattice gauge theories

Cochran, T. A., Jobst, B., Rosenberg, et al.

Abstract

Lattice gauge theories (LGTs)[1,2,3,4] can be used to understand a wide range of phenomena, from elementary particle scattering in high-energy physics to effective descriptions of many-body interactions in materials[5,6,7]. Studying dynamical properties of emergent phases can be challenging, as it requires solving many-body problems that are generally beyond perturbative limits[8,9,10]. Here we investigate the dynamics of local excitations in a \({{\mathbb{Z}}}_{2}\) LGT using a two-dimensional lattice of superconducting qubits. We first construct a simple variational circuit that prepares low-energy states that have a large overlap with the ground state; then we create charge excitations with local gates and simulate their quantum dynamics by means of a discretized time evolution. As the electric field coupling constant is increased, our measurements show signatures of transitioning from deconfined to confined dynamics. For confined excitations, the electric field induces a tension in the string connecting them. Our method allows us to experimentally image string dynamics in a (2+1)D LGT, from which we uncover two distinct regimes inside the confining phase: for weak confinement, the string fluctuates strongly in the transverse direction, whereas for strong confinement, transverse fluctuations are effectively frozen[11,12]. We also demonstrate a resonance condition at which dynamical string breaking is facilitated. Our LGT implementation on a quantum processor presents a new set of techniques for investigating emergent excitations and string dynamics.

MATERIALS

Passive cooling paint enabled by rational design of thermal-optical and mass transfer properties

Jipeng Fei, Xuan Zhang, et al.

Abstract

Integrating radiative and evaporative cooling shows promise for enhancing passive cooling, but durable self-curing integrated cooling paints remain underdeveloped. We designed a modified cementitious structure with advanced thermal-optical and mass transfer properties, boosting cooling power while ensuring durability, mechanical strength, and broad adhesion. The paint achieves 88 to 92% solar reflectance (depending on wetting), 95% atmospheric window emittance, ~30% water retention,

and self-replenishing properties, maintaining stable optical performance even when wet. Field tests in tropical Singapore demonstrated superior cooling performance compared with commercial white paints. Pilot-scale demonstrations highlighted consistent electricity savings under varying weather conditions, supported by theoretical modeling. By leveraging sustainable water evaporation and thermal radiation, this paint offers a practical and long-term solution for mitigating the urban heat island effect.

Interface morphogenesis with a deformable secondary phase in solid-state lithium batteries

Sun Geun Yoon, Bairav S. Vishnugopi, L., et al.

Abstract

The complex morphological evolution of lithium metal at the solid-state electrolyte interface limits performance of solid-state batteries, leading to inhomogeneous reactions and contact loss. Inspired by biological morphogenesis, we developed an interfacial self-regulation concept in which a deformable secondary phase dynamically aggregates at the interface in response to local electro-chemo-mechanical stimuli, enhancing contact. The stripping of a lithium electrode that contains 5 to 20 mole % electrochemically inactive sodium domains causes spontaneous sodium accumulation across the interface, with the sodium deforming to attain intimate electrical contact without blocking lithium transport. This process, characterized with operando x-ray tomography and electron microscopy, mitigates voiding and improves cycling at low stack pressures. The counterintuitive strategy of adding electrochemically inactive alkali metal to improve performance demonstrates the utility of interfacial self-regulation for solid-state batteries.

Vapor-assisted surface reconstruction enables outdoor-stable perovskite solar modules

Xiangnan Sun, Wenda Shi, et al.

Abstract

Natural illumination variations in light-dark cycles induce irreversible ion migration in perovskite solar cells, posing substantial challenges to their long-term outdoor operational stability. We addressed this issue by isolating defective octahedra at the perovskite surface using a vapor-deposited polydentate ligand. Surface octahedra isolation suppresses ion migration into the charge transport layer and reduces surface ionic defects, modulating the kinetics of ion migration during light-dark cycles. Our 785-square-centimeter industrial-scale perovskite solar modules achieved a power conversion efficiency (PCE) of 19.6%. Our modules demonstrated enhanced diurnal stability, retaining more than 97% of their initial PCE even after 101 light-dark cycles

at 50°C. Our perovskite modules maintained stable power output during 45 days of outdoor operation under severe summer conditions, exhibiting stability comparable with that of the reference silicon cell.

CHEMISTRY

Acid-humidified CO2 gas input for stable electrochemical CO2 reduction reaction

Shaoyun Hao, Ahmad Elgazzar, et. al

Abstract

(Bi)carbonate salt formation has been widely recognized as a primary factor in poor operational stability of the electrochemical carbon dioxide reduction reaction (CO2RR). We demonstrate that flowing CO2 gas into an acid bubbler—which carries trace amounts of acid vapor into a gas diffusion electrode for silver-catalyzed CO2RR to carbon monoxide (CO)—can prevent salt accumulation. In a 100-square-centimeter, scaled-up CO2RR membrane electrode assembly electrolyzer with single serpentine flow channels, the acid humidification method achieved the 4500 hours of stability milestone at 100 mA cm−2 without compromising the CO faradaic efficiency, whereas a conventional water-humidified CO2 feed only operated stably for ~80 hours. The acid-humidified CO2 approach was extended to bismuth, copper, and zinc catalysts.

In-insect synthesis of oxygen-doped molecular nanocarbons

Atsushi Usami, Hideya Kono, et. al

Abstract

Many functional molecules and materials have been produced with organic chemistry or with in vitro enzymatic approaches. Individual organisms, such as insects, have the potential to serve as natural reaction platforms in which high densities of multiple enzymes can perform new and complex reactions. We report an “in-insect” unnatural product synthesis that takes advantage of their xenobiotic metabolism. We selectively transform belt- and ring-shaped molecular nanocarbons into otherwise difficult-to-prepare derivatives in which oxygen atoms are inserted into aromatic rings. Cytochrome P450 variants are most likely the enzymes responsible for this reaction. Molecular dynamics simulations and quantum chemical calculations indicated a possible mode of substrate incorporation into the enzyme and an unconventional mechanism of direct oxygen insertion into carbon–carbon bonds.

Encapsulated Co–Ni alloy boosts high-temperature CO2 electroreduction

Ma, Wenchao, Morales-Vidal, et. al

Abstract

Electrochemical CO_2 reduction into chemicals and fuels holds great promise for renewable energy storage and carbon recycling[1,2,3]. Although high-temperature CO_2 electroreduction in solid oxide electrolysis cells is industrially relevant, current catalysts have modest energy efficiency and a limited lifetime at high current densities, generally below 70% and 200 h, respectively, at 1 A cm^{-2} and temperatures of 800 °C or higher[4,5,6,7,8]. Here we develop an encapsulated Co–Ni alloy catalyst using Sm_2O_3-doped CeO_2 that exhibits an energy efficiency of 90% and a lifetime of more than 2,000 h at 1 A cm^{-2} for high-temperature CO_2-to-CO conversion at 800 °C. Its selectivity towards CO is about 100%, and its single-pass yield reaches 90%. We show that the efficacy of our catalyst arises from its unique encapsulated structure and optimized alloy composition, which simultaneously enable enhanced CO_2 adsorption, moderate CO adsorption and suppressed metal agglomeration. This work provides an efficient strategy for the design of catalysts for high-temperature reactions that overcomes the typical trade-off between activity and stability and has potential industrial applications.

BIOLOGY

A metabolite-based resistance mechanism against malaria

Ana Figueiredo, Sonia Trikha Rastogi, et al.

Abstract

Jaundice is a common presentation of Plasmodium falciparum malaria, which arises from the accumulation of circulating bilirubin. It is not understood whether it represents an adaptive or maladaptive response to Plasmodium spp. infection. We found that asymptomatic P. falciparum infection in humans was associated with a higher ratio of unconjugated over conjugated bilirubin and parasite burden compared with symptomatic malaria. Genetic suppression of bilirubin synthesis by biliverdin reductase A (BVRA) increased parasite virulence and malaria mortality in mice. Accumulation of unconjugated bilirubin in plasma, through genetic inhibition of hepatic conjugation by UDP glucuronosyltransferase family 1 member A1 (UGT1A1), was protective against malaria in mice. Unconjugated bilirubin inhibited P. falciparum proliferation in red

blood cells by a mechanism that suppressed mitochondrial pyrimidine synthesis. Moreover, unconjugated bilirubin inhibited hemozoin crystallization and compromised the parasite's food vacuole. Hence, jaundice appears to represent a metabolic response to Plasmodium spp. infection that limits malaria severity.

Introgression dynamics of sex-linked chromosomal inversions shape the Malawi cichlid radiation

L. M. Blumer, V. Burskaia, et. al

Abstract

Chromosomal inversions can contribute to adaptive speciation by linking coadapted alleles. By querying 1375 genomes of the species-rich Malawi cichlid fish radiation, we discovered five large inversions segregating in the benthic subradiation that each suppress recombination over more than half a chromosome. Two inversions were transferred from deepwater pelagic Diplotaxodon through admixture, whereas the others established early in the deep benthic clade. Introgression of haplotypes from lineages inside and outside the Malawi radiation coincided with bursts of species diversification. Inversions show evidence for transient sex linkage, and a notable excess of protein changing substitutions points toward selection on neurosensory, physiological, and reproductive genes. These results indicate that repeated interplay between depth adaptation and sex-specific selection on large inversions has been central to the evolution of this iconic system.

Aberrant basal cell clonal dynamics shape early lung carcinogenesis

Sandra Gómez-López, Ahmed S. N. Alhendi, et. al

Abstract

Preinvasive squamous lung lesions are precursors of lung squamous cell carcinoma (LUSC). The cellular events underlying lesion formation are unknown. Using a carcinogen-induced model of LUSC with no added genetic hits or cell type bias, we find that carcinogen exposure leads to non-neutral competition among basal cells, aberrant clonal expansions, and basal cell mobilization along the airways. Ultimately, preinvasive lesions develop from a few highly mutated clones that dominate most of the bronchial tree. Multi-site sequencing in human patients confirms the presence of clonally related preinvasive lesions across distinct airway regions. Our work identifies a transition in basal cell clonal dynamics, and an associated shift in basal cell fate, as drivers of field cancerization in the lung.

Ⅲ Calling for papers

ICCEA 2025（EI）

Submission deadline: **Jun 30, 2025**
Conference date: **Dec 6, 2025 - Dec 8, 2025**
Full name: **International Conference on Civil Engineering and Architecture**
Location: **Jakarta, Indonesia**

The conference aims to present recent global developments in coastal engineering, environmental-friendly construction and development practices, green building materials, architectural design innovations, sustainable cultivation and conservation practices, land reclamation and re-purposing concepts, and advances in environmental analysis and monitoring. We will focus on the as-built world as we currently know it, and what is not known about cities and resource developments of the future. You are invited to submit a paper for consideration all over the globe interested in the areas of municipal engineering, smart materials, sustainable architecture, geotechnical engineering, civil engineering and materials, etc. Other applications of civil engineering and architecture are also welcome. Looking forward to welcoming you in Jakarta!

Call for papers:

The topics of interest for submission include, but are not limited to:

Theoretical and Advanced Technology of Engineering Structures
High-rise Buildings and Large-span Structures
Bridge and Tunnel Engineering
Newer Structures and Special Structures
Geotechnical Engineering
Municipal Engineering
Engineering Management
Innovative Technology, Method and Technique in Civil Engineering
Architectural Design and Planning
Architectural Theories
Project and Construction Processes
Urban Regeneration and Sustainable Development
Environment and Technology
Educational Topics in Civil Engineering and Architecture
Water and Wastewater Treatment
Environmental and Water Resources Planning and Management
Reuse and Recycle of Wastewater
Heating, Gas Supply, Ventilation and Air Conditioning Works
Sustainable Development of Building Energy and Environment
Energy Conservation
Environmental Engineering and Environmental Protection
Mitigation of Water Resources
Clean Technology Initiatives and Successes
Transportation Engineering
Road and Railway Engineering
Traffic Engineering
Construction and Renewable Energy Sources
Geological Engineering
Geographic Information Systems (GISs)
Environmental Management Systems (EMSs)
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ICEST 2025（SPRINGER）

Submission deadline: **Jul 20, 2025**
Conference date: **Nov 22, 2025 - Nov 24, 2025**
Full name: **16th International Conference on Environmental Science and Technology**
Location: **Tokyo, Japan**

Welcome to 2025 16th International Conference on Environmental Science and Technology (ICEST 2025) to be held during November 22-24, 2025 in Sophia University, Japan. The conference is organized by Sophia University, Japan, co-organized by International Society for Environmental Information Sciences and United Nations Development Programme. ICEST 2025 is to bring together innovative academics and industrial experts in the field of Environmental Science and Technology to a common forum. Welcome scholars and researchers working in the field of Environmental Science and Technology from all over the world to attend the conference and share your experiences and lessons with other enthusiasts, and develop opportunities for cooperation.
The ICEST conference has been successfully held for 15 editions in the field of Environmental Science and Technology, successively in Bangkok, Singapore, Poland, Barcelona, Madrid, the Czech Republic, China and other locations around the world. The conference provides a forum for researchers and practitioners in this field to exchange ideas, designs, and experiments, promoting academic exchange and international cooperation in related fields.

Topics of Interest :

The topics of interest for submission include, but are not limited to:

Ecosystem Management and Sustainable Development
Environmental Monitoring and Management
Water Resources Management and Water Pollution Control
Atmospheric science and air pollution control
Solid Waste Pollution Control and Resource Utilization
Global environmental change and ecosystems management
Health and the Environment
Water resources and river basin management
Climate and climatic changes
Optimization of collection systems
……

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PREE 2025（EI）

Submission deadline: **Jul 20, 2025**
Conference date: **Oct 28, 2025 - Oct 31, 2025**
Full name: **International Conference on Power and Renewable Energy Engineering**
Location: **Nara, Japan**

We're glad to announce that 2025 3rd International Conference on Power and Renewable Energy Engineering (PREE) will be held in Nara, Japan from October 28, 2025 to October 31, 2025.
The conference aims to promote quality research and real-world impact in an atmosphere of true international cooperation between scientists and engineers. PREE welcomes scholars and researchers worldwide to submit papers related with power and renewable energy engineering for presentation as well as publication.
PREE will be featured with keynote talks, invited speeches, special sessions and regular paper presentations, making it an ideal platform for people to share views and experiences in the filed of power and renewable energy engineering.

Call for Papers:
The topics of interest for submission include, but are not limited to:
Wind energy systems
Renewable energy utilizations
New energy applications
Energy-saving technology
Energy storage technologies and devices
Power and energy generation
Energy transmission and distribution
Power electronics
Electricity markets
High voltage engineering
Low-carbon energy system
Hybrid energy systems
Storage technology
Grid and off-grid issues
Remote area power supply
Power system technology
Innovations in renewable energy
Sustainable energy and environment
Zero energy building
Waste management
Energy management / audit
Energy policies and economics
Energy efficient systems
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ICAISD 2025（EI/SCOPUS）

Submission deadline: **Aug 12, 2025**
Conference date: **Sep 12, 2025 - Sep 14, 2025**
Full name: **International Conference on Artificial Intelligence and Sustainable Development**
Location: **Beijing, China**

2025 International Conference on Artificial Intelligence and Sustainable Development (ICAISD 2025) will be held in Shanghai, China on November 14-16, 2025.
The conference aims to bring together the world's leading academics, researchers, industry experts and business people to discuss the important topic of how artificial intelligence technology can help achieve sustainable development. The conference will focus on cutting-edge research results and innovative applications of artificial Intelligence in the fields of climate change, clean energy management, smart cities, environmental monitoring, agricultural intelligence, and disaster management. Through in-depth exchanges and interdisciplinary cooperation, ICAISD 2025 aims to promote the practical application ofartificial Intelligence technologies in solving global sustainability challenges, improving resource efficiency, environmental protection and social well-being. Participants will have the opportunity to share the latest research results, discuss key technical issues, promote the integration of industry, university and research, and jointly promote the goal of global sustainable development.
ICAISD 2025 looks forward to your participation as we work together towards a better future.

***Call for papers:**
The topics of interest for submission include, but are not limited to:

- Application of artificial intelligence to climate modeling and prediction
- Meteorological data processing and analysis
- Application of artificial intelligence in clean energy management
- Smart grid and energy optimization
- Renewable energy forecasting and scheduling
- Pattern recognition and optimization of energy consumption
- Integration and decentralization of renewable energy resources
- The application of artificial intelligence in smart cities
- Integrated analysis of environmental factors and health data
- Application of artificial intelligence in water resources managemen
- Intelligent water treatment system
- Application of artificial intelligence in disaster prediction and management
- Application of artificial intelligence in pollution control and environmental remediation
- Application of artificial intelligence in natural resource conservation
- Artificial intelligence in sustainable manufacturing
- Application of artificial intelligence in education and research

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ICRER 2025

Submission deadline:	**Jul 20, 2025**
Conference date:	**Oct 10, 2025 - Oct 12, 2025**
Full name:	**International Conference on Resources and Environmental Research**
Location:	**Bali, Indonesia**

2025 7th International Conference on Resources and Environmental Research (ICRER 2025), the annual premier resources and environmental research development meeting, is going to be held during October 10-12, 2025, in Bali, Indonesia. ICRER 2025 is co-sponsored by Universitas Riau, Indonesia and Beijing CAS Industrial Energy and Environment Technology Institute.
ICRER is an annual conference in the Asia-Pacific Region that attracts industry practitioners, policy makers and researchers to share and exchange the experiences, ideas and technologies about the field. Interest in resources and environmental research with novel achievements has remarkably increased in recent years. You are encouraged to submit your researches in form of full papers or abstracts.
We truly believe that ICRER 2025 will achieve greater success and provide a better platform for all the participants to have fruitful discussions and to share ideas of researches. With high standard and high quality submissions and presetations during the three days' conference, it will be plenty of opportunities for you to showcase your work in front of professionals in the resources and environmental research sector at this popular conference.

Topics of interest

1)Environmental Science and Technology

●Mechanism of multi-media migration and transformation of new pollutants
●Treatment and recycling technology of high salt wastewater
●Collaborative governance mechanism and key path of atmospheric pollution reduction and carbon reduction
●Ecological effects of microplastics in offshore waters
●Study on carbon sequestration and accumulation in coastal wetland ecosystem
●Application of machine learning to Earth system observation and prediction
●Study on biological characteristics and ecological effects of microorganisms in Marine extreme environment
●Study on clean production technology of tanning without tanning agent
●Food function factors and the mechanism of chronic metabolic syndrome
●Extraction and development of new natural cellulose fibers

2)Environmental Ecological Engineering

●Ecosystem Management and Sustainable Development
●Global environmental change and ecosystems management
●Environmental restoration and ecological engineering
●Habitat reconstruction

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●Deforestation
●Wetlands
●Landscape degradation and restoration
●Soil decontamination
●Environmental Monitoring and Management
●Hazardous substances and detection techniques
●Biodegradation of hazardous substances
●Toxicity assessment and epidemiological studies
●Management and regulation of point and diffuse pollution
●Monitoring and analysis of environmental contaminant
●Quality guidelines, environmental regulation and monitoring

3)Resources and Environment Engineering
●Water Resources Management and Water Pollution Control
●Atmospheric science and air pollution control
●Solid Waste Pollution Control and Resource Utilization
●Ground water remediation and management
●Global environmental change and ecosystems management
●Climate and climatic changes
●Global warming
●Ozone layer depletion
●Carbon capture and storage
●Recycling and reuse
●Waste valorization

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