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Room Golden State Ballroom - Session TS2-ThP
(Photo)electrocatalysis and Solar/Thermal Conversion Poster Session

TS2-ThP-2 Synthesis and Photocatalytic Efficiency of Bismuth-Copper Selenide Chitosan Microspheres for Micropollutant Degradation under Solar Radiation, ***Sayed Suliman Shah,*** The Molecular Innovation and Applications Laboratory (LIMA), University of Strasbourg, France

Among the top trending environmental concerns, water pollution has got a serious attention these days. Technological advancement in industrial sectors for manufacture of diverse products particularly micropollutants is the principle reason by discharging the wastewater of unit operations. In this context various percussive strategies have been followed among which photocatalysis is considered cheap, ideal and eco-friendly in nature . In this work, an effort has been made to have synthesize an effective catalyst bismuth-copper selenide chitosan microspheres via solvothermal process in order to degrade micropollutants in wastewater under solar radiations. The synthesized catalyst nano composite was fabricated withpolyaniline (PANI) being conductive in nature for better photocatalytic efficiency and characterized with FTIR, SEM, EDX and XRD. The photocatalytic nature of the catalyst was examined by varying different variables namely pollutant concentration, catalyst dose, pH, degradation time and batches.

TS2-ThP-3 Dual-Metal Doped Perovskite Oxides: High-Performance Fenton-Like Catalysts for Antibiotic Degradation, ***Thi Xuyen Nguyen,*** *Yong Yu, Chia-Ying Su, Jyh-Ming Ting,* National Cheng Kung University (NCKU), Taiwan

Water pollution from organic wastewater has become a significant global concern. The Fenton-like process is an effective and practical method for reducing organic pollutants. In this study, we synthesized a dual-metal of Cu and Mn co-doped in $LaFeO_3$ perovskite oxide using a simple co-precipitation method. The obtained $La(FeCuMn)O_3$ achieves a remarkable 90.3% removal rate of high-concentration tetracycline (40 ppm) within 30 min without requiring additional light irradiation. This performance is six times higher than that of pristine $LaFeO_3$ and surpasses that of single-metal-doped samples ($LaFeCuO_3$ and $LaFeMnO_3$). We found that the oxygen vacancies induced by doping can enhance the pollutant adsorption, while Cu^+ facilitates the regeneration of Fe^{2+} and Mn promotes charge redistribution. The synergistic effects of dual-metal co-doping substantially enhance Fenton activity.

TS2-ThP-4 3D Atmospheric Plasma Beam TiO_2 Lamination of Porous Structures for Manufacturing Electro-Photocatalytic Reactors, ***Yuri Glukhoy,*** Nanocoating Plasma Systems Inc, USA*; Michael Ryaboy,* nanocoating plasma systems inc, USA

Nanocoating Plasma Systems has developed electro-photocatalytic (EPCO) reactor with matrix's honeycomb structure made from welded together quartz capillaries with ID 0.5 mm and 7 mm long/ Due to such a design component like electric field applied to the matrix can increase the area of disinfection. When exposed to moisture (water vapor) and light, TiO2 undergoes excitation that produces electron-hole pairs, which in turn react with water molecules to form $OH^{\cdot}$ and other reactive species, this reaction is further enhanced by the electric field which not only accelerates the production of hydroxyls but also drives their propagation into the surrounding space. This phenomenon called chain reaction is the process, where the ejected from the matrix and energized by a high voltage hydroxyl radicals collide with water molecules in the room to produce secondary hydroxyl radicals. It is essential for extending the disinfecting effects over larger areas and reducing pathogen concentrations rapidly. NPS have used the focused the RF plasma beam carrying the TiO2 nanoparticles is commonly employed to provide the 2D nanocoating for different application. However, transition to the TiO2 lamination of the 3D object like the matrix with the capillaries' holes with a high aspect ratio is complicated by the negative charge passivating the entrance of these holes and rejecting the beam. ionize gases and control plasma behavior at atmospheric pressure. This phenomenon called Debye Plasma Law makes impossible lamination of the matrix. To breach this law NPS has applied the auxiliary RF discharge at the exit of the capillary holes. It generates the hollow discharge inside the hole neutralizing the parasitic charge at the entrance. Therefore, the plasma beam is able to penetrate into the interior of the holes, where the TiO2 coating is deposited on the inner walls. This technique not only overcomes the challenges of applying uniform coatings to complex geometries (such as the small and intricate capillary structures) but also, taking in account the electrical component, ensures enhancing chain reaction to enlarge the disinfection area. Involving the RF plasma beam helps to solve another problem like a low photo-catalytic activity of the commercial TiO2 nanoparticles with a bandgap about 3.2 eV limited just by UV that includes just 4% of solar spectrum. Therefore, besides generation the fine plasma beam, the nitrogen plasma discharge provides the N-doping of the TiO2 nanoparticle generates the fine plasma beam particles reducing the bandgap up to 2.75 eV for absorption of all spectrum of visible spectrum.

TS2-ThP-5 Novel Self-Assembled Materials for Indoor Perovskite Solar Cells, ***Chieh-Cheng Lu,*** *Chih-Ping Chen, Yan-Ru Lin, Zhong-En Shi,* Ming Chi University of Technology, Taiwan, Republic of China

Perovskite Solar Cells (PSCs) have emerged as a research hotspot for next-generation solar technology due to their high efficiency and low-cost fabrication. This study employs hydrophobic hole transport materials as interfacial layers in p-i-n type perovskite solar cells. Among the four materials investigated, the first two (HYT-H and CIM-H) are molecular materials based on a carbazole (Carbazole) core, while the latter two (HYT oCl and CIM-oCl) are derivatives of the former materials with additional chloro-functional groups. Notably, CIM-oCl exhibits excellent crystallinity, reduced non-radiative recombination, and longer carrier lifetimes. Under AM1.5G conditions, the p-i-n type perovskite solar cell with a NiO_X / CIM oCl bilayer hole transport layer achieved an optimal efficiency of 19.19%. Among the materials, those with added chlorine (Cl) elements showed the most significant improvement in V_{OC}. Under a 3000K LED light source (1000 lux), CIM-oCl demonstrated the best efficiency performance at 37.37%.

TS2-ThP-6 Perovskite Solar Cell with Potassium Chloride Treated SnO2 Electron Transport Layer for Increased Efficiency, ***Akhil Prio Chakma,*** *Biplav Dahal, Tewelde Semere, Hongmei Dang,* University of The District of Columbia, USA

Perovskite solar cells (PSCs) have emerged as a promising candidate for next-generation photovoltaicsdue to their low fabrication cost and high-power conversion efficiency (PCE). However, recombination losses and charge transport issues at the interface between SnO_2 electron transport layer (ETL) and perovskite absorber are hindering the performance improvement. The SnO_2 surface often has oxygen vacancies and other defects that act as trap sites for electrons. These defects can lead to charge recombination, reducing the efficiency of charge extraction. This study demonstrates that potassium chloride (KCl) surface treatment of SnO_2 helps passivate these surface defects. Potassium ions (K^+) can fill oxygen vacancies, reducing trap density, mitigating recombination losses, and decreasing hysteresis in the current-voltage (I-V) characteristics. Characterization using scanning electron microscopy (SEM), atomic force microscopy (AFM), kelvin probe force microscopy (KPFM) confirmed better surface morphology and larger grain sizes onKCl treated SnO_2 and the corresponding perovskite layer. X-ray diffraction (XRD) analysis further revealed enhanced crystallinity, which is evident by intense diffraction peaks and reduced full-width half maximum (FWHM) compared to control samples. Photovoltaic performance measurements demonstrated improvements in device performance after KCl treatment. The best performing KCl based PSCs showed a PCE of 21%, fill factor of 77%,open-circuit voltage (V_{OC}) of 1.08V, and short-circuit current density (J_{SC}) of 25 mA/cm^2. The KCl based PSCs demonstrated that average efficiency is about 25% higher than control samples. These results highlight the effectiveness of KCl surface treatment in enhancing charge extraction, enhancing crystalline, reducing recombination losses, and improving overall device performance, making it a promising strategy for advancing high-efficiency PSCs.

Keywords: Perovskite Solar Cells, Electron Transport Layer, Efficiency, Atomic Force Microscopy, Kelvin Probe Force Microscopy, Scanning Electron Microscopy, Forward Width at Half Maximum.

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