

Spotlights on Recent JACS Publications

■ ANGULAR GEOMETRY STABILIZES NOTORIOUSLY REACTIVE ORGANIC SEMICONDUCTORS

Polyacenes, composed of linearly fused benzene rings, are known for their unique electronic properties such as high charge-carrier mobility. The most well-studied polyacene is the fused, five-ring pentacene, which has already been successfully incorporated in organic electronic applications. Scientists are interested in studying larger polycyclic aromatic hydrocarbons, which may have even more desirable properties than their smaller counterparts. But large polyacenes typically suffer from reduced stability, small band gaps, and high reactivity with light and oxygen.

To get around these issues, researchers led by Alejandro L. Briseno have synthesized a new class of polyacenes composed of eight angular fused rings, known as bistetracene (DOI: 10.1021/ja503643s). They find that the new angular geometry helps stabilize the molecules while retaining their excellent intrinsic charge transport properties. The team demonstrates that the soluble bistetracene derivatives are stable in air and processable in solution, and have low-energy band gaps and high charge-carrier mobility, which opens the door to exploring their use in mainstream applications such as solar cells and organic field-effect transistors.

Christine Herman, Ph.D.

■ ONE AT A TIME: RESOLVING SINGLE ELECTROCATALYTIC NANOPARTICLE COLLISIONS

Metal nanoparticles attract great interest in basic and applied research due to their unique size- and shape-tunable electronic, optical, and catalytic properties. Traditionally, nanoparticle electrochemistry is quantified through measurements of nanoparticle ensembles, resulting only in ensemble-averaged properties. The ability to measure single-nanoparticle catalytic reactions is vital in order to help identify new catalysts.

Now Bo Zhang and co-workers use fast-scan cyclic voltammetry (FSCV) to measure chemically resolved transient collision events of single electrocatalytic nanoparticles (DOI: 10.1021/ja503656a). In this study, the authors apply a fast and repetitive voltage signal on an inert ultramicroelectrode and then record its response as single electrocatalytic metal nanoparticles undergo collision processes with the electrode. The results contain chemically resolved information about transient particle–electrode interactions with millisecond time resolution prior to and after particle collision and immobilization.

The authors note that FSCV extends the single-particle collision concept to gain necessary chemical information, which is otherwise difficult to achieve with earlier constant potential methods. This method can be particularly valuable for mechanistic studies of particle–electrode interactions, particle activation and deactivation, and heterogeneous electron-transfer kinetics, for example.

Hui Jin, Ph.D.

■ METAL SULFIDES GET SPONGY

Mesoporous materials are filled with many tiny holes, and anyone familiar with sponges can understand how the holes help these materials often outperform their non-perforated counterparts with regard to trapping liquids or gases. The holes increase the material's surface area—ideal for functions that include gas sensing, chemical conversion, separation, solar cells, and batteries. Unfortunately, highly sought-after mesoporous metal sulfides have been difficult to create, in part because their components can shrink so much during fabrication until what is left resembles an array of particles rather than a network of holes.

Feng Jiao and colleagues present a method to create porous sulfides of iron, nickel, and cobalt with highly reactive crystalline walls (DOI: 10.1021/ja504407e). The researchers use a porous template and a clever oxide-to-sulfide transformation to create the mesoporous materials without the shrinkage problem. In simple performance tests, the holey sulfides speed degradation of a blue dye in water faster than non-porous catalysts with identical crystal structures.

The method is simple and can be generally applied to many metal sulfide materials. With improved performance, these materials can increase efficiency in fuel cells, solar energy generation, catalytic pollution control, and many other applications.

Jenny Morber, Ph.D.

■ HOW A SUPRAMOLECULE PUTS ITSELF TOGETHER DEPENDS ON SOLUTION

Bert Meijer, Sam Stupp, and colleagues show how the recipe scientists use to make a class of biomedically relevant supramolecules influences how these species assemble themselves into specific morphologies (DOI: 10.1021/ja503882s).

Peptide amphiphiles are self-assembling supramolecules that can orient themselves into long, thin nanofibers that carry peptides on their surfaces. Researchers have successfully designed them for use in various biomedical applications, including as scaffolds to help regenerate cells or as platforms for delivering peptides with biological activity.

Now, scientists want to understand how these amphiphiles self-assemble so that the researchers can fine-tune the molecules' properties for use in these applications. Here, Meijer, Stupp, and co-workers find that one of the amphiphiles can assemble into either long filaments or smaller aggregates, depending on the type of solution or the protocol used to prepare the molecules.

The work could help researchers develop peptide amphiphiles with improved function for treating spinal cord injury and regenerating bone and cartilage, among other biomedical applications.

Deirdre Lockwood, Ph.D.

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