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Spotlights on Recent *JACS* Publications

COBALT-BASED COMPLEX CLEAVES PEPTIDES INVOLVED IN ALZHEIMER'S DISEASE

Mi Hee Lim, Jaeheung Cho, Kiyoung Park, Sun Hee Kim, and colleagues describe tunable metal complexes that are capable of *in vitro* cleavage of amyloid-β (Aβ) peptides—the aggregation-prone peptides that are a primary component of senile plaques in the brains of patients with Alzheimer's disease—under biologically relevant conditions (DOI: 10.1021/jacs.6b09681). Alzheimer's disease is the most common form of dementia and the sixth leading cause of death among adults. Mounting evidence suggests Aβ is a key contributor to neurodegeneration, and until recently, little attention has been given to the development of transition metal complexes as Aβ management strategies.

The team has especially created a simple cobalt(II)-based complex and finds that it can hydrolyze Aβ peptides and control their aggregation. Analyses show that the complex has the potential to penetrate the blood−brain barrier, has low proteolytic activity against non-amyloid proteins, and can mitigate Aβ-linked toxicity in living cells. The results reveal the potential for transition metal complexes to play a role in the battle against amyloid-associated diseases.

Christine Herman, Ph.D.

GOING BEYOND THE SURFACE OF SURFACE COORDINATION CHEMISTRY

Ligands on metal nanoparticles were once thought to offer no advantages for catalysis and were therefore frequently removed. However, Nanfeng Zheng, Gang Fu, and co-workers demonstrate in a new Perspective that the ligand coordination on surface metal atoms can greatly influence the synthesis and catalytic properties of nanomaterials at the molecular level (DOI: 10.1021/jacs.6b10978). Gaining better knowledge of surface coordination chemistry on metal nanoparticles, the authors say, offers the promise of customizing their characteristics, such as shape, catalytic activity, and selectivity.

The authors detail the power of small ligands, including halides, CO, and amines, to synthesize noble metal nanocrystals with shapes beyond their normal near-spherical morphologies upon binding. For example, CO can steer palladium to form ultrathin nanosheets that are difficult to form by other means. Ligands can also have profound effects on catalysis via steric interactions and electronic modifications, significantly changing the selectivity of reactions. Although these phenomena have been well researched in the past few decades, tools are still lacking to characterize surface coordination on metal nanoparticles, a step necessary to tailor the effects of ligands. The authors note that further development of this field will require extensive collaborations among materials science, spectroscopy, computational chemistry, and catalysis.

Christen Brownlee

ONE STEP TOWARD ONE-DIMENSIONAL BORON MATERIAL

In the past several decades, researchers have produced a wealth of exotic forms of carbon, including fullerenes, nanotubes, graphene, and one-dimensional (1D) chains known as carbynes. Recently, scientists have made headway with a similar revolution in boron, synthesizing boron fullerenes, atomically thin two-dimensional films, and elongated ribbon-like and tubular clusters. Boris Yakobson, Vasilii Artyukhov, and co-workers take this field to a single dimension, showing the feasibility of two isomers of 1D boron (DOI: 10.1021/jacs.6b12750).

Density functional theory calculations show that 1D boron can exist as either a two-atom-wide ribbon or a single-atom carbyne-like chain. Applying strain (external tension or temperature) to the ribbon results in a smooth transformation to the chain form through a series of nucleation events as bonds sequentially break, leading to a linear-chain-conformation. Releasing strain reverses this process, transforming the chain back to a ribbon. Further investigation suggests that these two isomers have other distinct properties: for example, while the ribbon form behaves like a metal, the chain acts like a wide-gap semiconductor with tunable properties that depend on the degree of strain. The authors suggest that 1D boron, once it is eventually synthesized, could lead to a variety of interesting electromechanical applications.

Christen Brownlee

NITROGEN DOPING INDUCES FERROMAGNETISM IN GRAPHENE

Graphene, a form of two-dimensional carbon, has potential applications in lightweight, flexible electronics and spintronics, owing to its high charge carrier mobility and weak spin−orbit coupling. Researchers are interested in developing graphene for optoelectronic and solid-state devices, but, for certain applications, graphene's electronic properties would need to be tweaked first. One way to accomplish this type of modification is through doping, the process of intentionally introducing impurities to an otherwise pure material. Doping graphene with non-metal atoms, such as sulfur and nitrogen, has been previously shown to induce paramagnetism, making the material weakly attracted to the poles of a magnet but not permanently magnetic. But doping graphene to induce permanent magnetism (also known as ferromagnetism) without compromising conductivity has yet to be done.

Researchers led by Radek Zboril and Michal Otyepka demonstrate for the first time that doping graphene with a particular form of nitrogen can achieve just that (DOI: 10.1021/jacs.6b12934). Computational studies on the three chemical forms of nitrogen dopant—graphitic, pyridinic, and chemisorbed—reveal that magnetic effects are triggered by graphitic nitrogen. These findings may open up possible applications of graphene in spintronic materials.

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