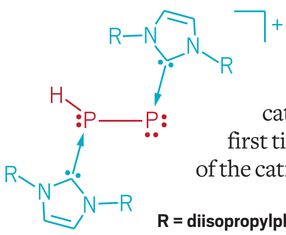
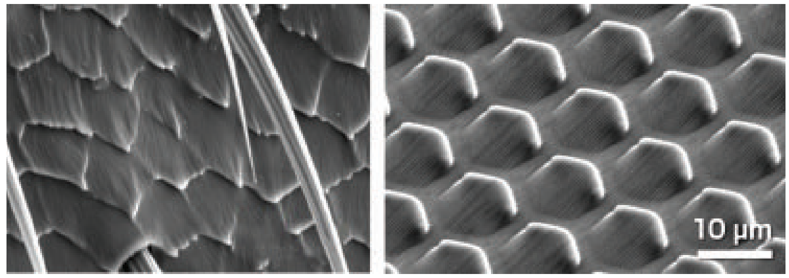
INORGANIC CHEMISTRY

▶ The first phosphaphosphenium cation

Researchers who spend their time seeking out strange new molecules made from main-group elements have enjoyed great success in recent years thanks to the discovery of N-heterocyclic carbenes (NHCs). These Lewis bases with a sturdy lone pair of electrons can bind and stabilize metals and molecule fragments in ways not possible before. In the latest example, Yuzhong Wang, Gregory H. Robinson, and coworkers of the University of Georgia have used the NHC-stabilization strategy to prepare the parent phosphaphosphenium cation, HP_2^+, for the first time. The complexity of the cation's name hints that chemists have had a complex time isolating the deceptively simple species, previously only detecting it in gas-phase experiments. To make HP_2^+, Robinson and coworkers used pyridine hydrochloride ($HCl{\bullet}NC_5H_5$) to protonate NHC-stabilized diphosphorus, P_2, another compound they previously tamed. Unlike its nitrogen analog, N_2, diphosphorus is unstable. The Georgia team further obtained the X-ray crystal structure of NHC-stabilized HP_2^+ and conducted spectroscopic and computational bonding analyses (*Chem. Commun.* 2016, DOI: 10.1039/c6cc0175b). The findings could lead to better understanding of how to use diphosphorus in organic synthesis and materials science, for example, similar to how aryl diazonium cations RN_2^+ are used in palladium-catalyzed cross-coupling reactions.—STEVE RITTER



NHC-stabilized phosphaphosphenium



Tiled microstructures on a firefly lantern (left) make it shine brighter. The man-made mimic (right) has the same effect.

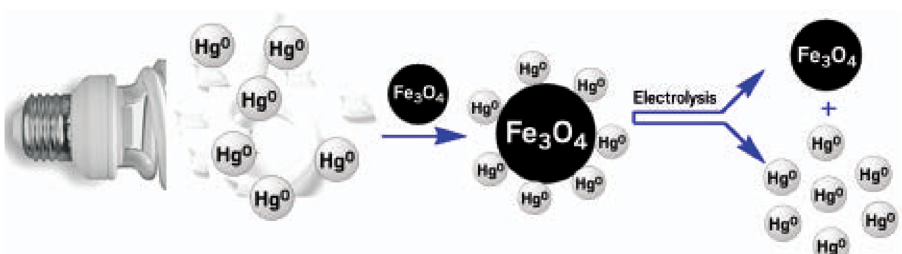
MATERIALS

Firefly-inspired LED shines brighter

An organic light-emitting diode that mimics the three-layered structure of a firefly's lantern shines brighter than conventional OLEDs, a development that could lead to TV and computer screens that use less energy (*Nano Lett.* 2016, DOI: 10.1021/acs.nanolett.5b05183). The lantern of the firefly species *Pyrocoelia rufa* is covered in chitin structures 10 μm wide that lie like roofing tiles, with nanoscale ridges decorating their surfaces. These structures better match the index of refraction of air than plain chitin, and they reduce internal reflection, which improves light transmission out of the lantern. Below the chitin lies a layer of light-producing tissue, and below that is a light-reflective layer that bounces light out of the lantern. Ki-Hun Jeong of the Korea Advanced Institute of Science & Technology and colleagues mimicked these layers in their design: The top layer is a polymer resin patterned with chitin-like structures, followed by a layer of standard green OLED material and then an aluminum reflector. The bioinspired OLED shines about 60% brighter than a conventional green OLED, Jeong says.—KATHERINE BOURZAC, special to C&EN

ENVIRONMENT

▶ Reclaiming mercury from spent fluorescent bulbs



Removing and reusing mercury from spent compact fluorescent lightbulbs helps keep the toxic element out of landfills, where it can enter the environment. In an effort to advance mercury recycling, researchers have developed a technique for processing spent CFLs that's more energy efficient than current methods (*ACS Sustainable Chem. Eng.* 2016, DOI: 10.1021/acssuschemeng.5b01612). Existing recovery methods evaporate mercury at high temperature, separating it from other materials in the bulbs. Parisa A. Ariya of McGill University and her colleagues instead use iron oxide nanoparticles to trap mercury at near room temperature without heating. The team broke open CFLs within a vessel that was connected to a chamber loaded with nanoparticles. As mercury vapor from the bulbs flowed into the chamber, it stuck to the nanoparticles. The team then used magnets to transfer the nanoparticles to an electrochemical reactor in which the researchers drove off ionic mercury species and reduced them to elemental mercury. Their prototype system recovered up to 85% of the mercury and required only 20 W of power, little enough for a small solar panel to provide.—MELISSA PANDIKA, special to C&EN

In a new recycling process, magnetic Fe_3O_4 nanoparticles remove mercury vapor from spent fluorescent bulbs, followed by electrochemical separation to pull the mercury off the nanoparticles for reuse.

CREDIT: *NANO LETT.* (MICROGRAPHS); *ACS SUSTAINABLE CHEM. ENG.* (SCHEMATIC)