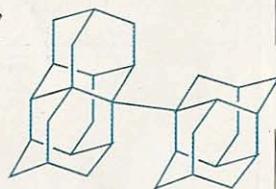


## HEMOGLOBIN DEGRADATION COMPOUNDS REVEALED

Researchers have found three breakdown intermediates of human hemoglobin that form when ubiquitous nitrite anions from soil, plants, and other sources interact with the protein. Hemoglobin plays a central role in oxygen binding and transport and nitric oxide signaling. Nitrite binding to the protein is a physiologically important process that can induce hemoglobin degradation. In some cases, the degradation leads to loss of one or more of hemoglobin's four heme groups, and such heme losses are known to occur in malaria and other blood-borne diseases. But no structural information on hemoglobin's nitrite-induced degradation intermediates was available. Now, research assistant professor Jun Yi and professor George B. Richter-Addo of the University of Oklahoma, Norman, and coworkers have used X-ray crystallography to structurally analyze several breakdown products (*Biochemistry*, DOI: 10.1021/bi2009322). One is a hemoglobin compound in which heme is displaced 4.8 Å from its normal location—the largest heme slippage observed for any heme protein—and in which nitrite is bound in an unprecedented way. The results provide structural insights into a possible pathway for nitrite-induced heme loss from human hemoglobin, the researchers note.—SB

## CARBON-CARBON BONDS THAT ARE LONG AND STRONG

A record has been set for the longest carbon-carbon bond in an alkane. A team led by Peter R. Schreiner of Germany's Justus Liebig University, Giessen, and Andrey A. Fokin of Ukraine's Kiev Polytechnic Institute report they have made an alkane with a C-C bond that's 1.704 Å long (*Nature*, DOI: 10.1038/nature10367). Typical alkane C-C bonds measure 1.54 Å. The extra-long bond links two diamondoid structures (shown) and exhibits considerable strength, despite its length. Noticeable decomposition of the material occurs only at temperatures above 200 °C. Schreiner, Fokin,



Coupled diamondoids

## GIANT CRYSTALS GROW SUPERSLOWLY

Scientists studying the geochemical processes at play in the formation of giant gypsum crystals ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) found in Mexico's Naica ore mines have determined that these natural wonders—up to about 35 feet long and 3 feet thick—grow much more slowly than a snail's pace, taking up to 1 million years to reach their current size. To study the crystals, a team led by Juan Manuel García-Ruiz of the University of Granada, in Spain, cleaned a chunk of one of the giant crystals to activate growth sites and then immersed it in mineral-rich water from a Naica cavern. The researchers then watched the crystals grow by using a white-light phase-shift interference microscope they developed—a type of high-resolution interferometer (*Proc. Natl. Acad. Sci. USA*, DOI: 10.1073/pnas.1105233108). The crystal growth proceeds slowly because the chemical equilibrium is barely shifted in favor of crystal growth over gypsum solubility, the researchers note. The slowest measurable growth rate of about 16 femtometers per second occurred at 55 °C, the natural temperature of the Naica water. At that rate it would take about 990,000 years for one of the giant crystals to grow, they estimate.—SR



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*These calcium sulfate crystals, shown in a natural deposit in Mexico, formed over hundreds of thousands of years.*

and coworkers attribute this stability to intramolecular attractive dispersion interactions—also known as London forces—between hydrogen atoms on the surface of the diamondoids near the elongated C-C bond. They used quantum chemical computations to show that this is the case. “Our findings have consequences for understanding rotational barriers and thermodynamic preferences of branched alkanes over linear alkanes and for the design of structures using attractive dispersion interactions,” the researchers note.—BH

## STAINING MAKES CATALYTIC SITES FLUORESC

A fluorescence microscopy method can be used to image catalytically active regions of selectively stained industrial catalyst particles, according to a team of researchers in the Netherlands and the U.S. (*Nat. Chem.*, DOI: 10.1038/nchem.1148). The method, which was developed to probe

acidic functionality in solid catalysts, provides a new diagnostic imaging tool for monitoring catalyst aging and deactivation. Motivated by biological tissue staining methods, Inge L. C. Buurmans, Javier Ruiz-Martínez, and Bert M. Weckhuysen of Utrecht University, and coworkers selectively delivered the heterocyclic compound thiophene to acid sites in fluid catalytic cracking (FCC) catalysts, a workhorse petroleum refining catalyst. Commercial FCC catalysts are typically formulated as micrometer-sized particles of zeolite Y in a matrix of clay, alumina, and silica. Then by applying a thermal treatment, the team oligomerized thiophene at the zeolite acid sites to form fluorescent probe molecules at those catalytically active positions. They selectively treated the matrix with a different dye. In that way, the team was able to compare fluorescence signals from individual fresh catalyst particles with various aged and deactivated ones and develop a correlation between fluorescence intensity and catalytic cracking activity.—MJ