

STRETCHY INSIGHTS

ACS MEETING NEWS: Molecular force probe reveals how strain affects reactivity

PULLING ON A RUBBER BAND seems like a good analogy for stretching a bond, but chemists are learning that what happens in our world

doesn't always hold up on a molecular scale. The findings, presented to the Division of Organic Chemistry on Aug. 19 at the ACS national meeting in Washington, D.C., illuminate how molecules respond to strain and might have implications in biology and materials science.

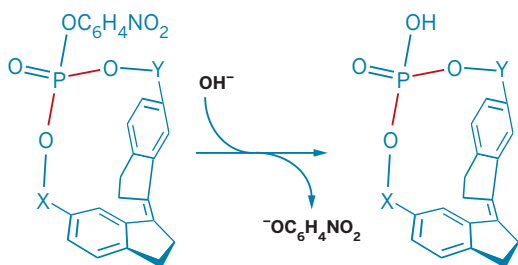
Analyzing how

strain affects individual chemical bonds is difficult with established force measurement techniques such as atomic force microscopy because small-scale events tend to be obscured. So chemistry professor Roman Boulatov and coworkers at the University of Illinois, Urbana-Champaign, designed a miniature force probe. They connect a rigid hydrocarbon that he calls stiff stilbene to molecules of interest via inert organic linkers. Shining light on stiff stilbene triggers a dramatic change in its shape, which stretches the molecule under observation in a controllable manner (*Nat. Nanotech.* 2009, 4, 302).

Boulatov's probes allow reaction rates to be quantified as a function of restoring force, which describes how much a molecule was distorted and in what direction. "This technology should allow researchers to probe the structures of transition states, which are difficult to observe experimentally," says Duke University mechanochemistry researcher Stephen L. Craig, who did not attend the meeting.

In preliminary work presented at the meeting, Boulatov showed that hydrolysis of one P-O bond in a triphosphoester speeds up when bonds perpendicular to it are stretched. Although P-O bond hydrolysis is highly biologically relevant, it's too early to speculate whether this kind of stretching happens in nature, Boulatov added. —CARMEN DRAHL

HEAVE-HO Hydrolysis of a P-O bond goes faster when pulling bonds (red) orthogonal to it.



X, Y = inert organic linkers

COBALT GENERATES MAGNETIC POLYMER

ACS MEETING NEWS: Organized nanostructure is crucial for the block copolymer's magnetic properties

BY INCORPORATING a monomer with a cobalt ligand into a block copolymer, researchers have produced a magnetic material that could vastly

increase the density of information storage. Gregory N. Tew, professor of polymer science and engineering at the University of Massachusetts, Amherst, reported the material on Aug. 17 at the ACS national meeting in Washington, D.C.

By contrast, Tew said, a homopolymer formed solely from the cobalt-containing monomer is not magnetic.

"As far as I know, this is the first report of a processible, ferromagnetic polymer that is prepared at room temperature and is magnetic at room tempera-

ture," commented University of Bristol chemistry professor Ian Manners, who has studied metal-containing polymers for almost 20 years.

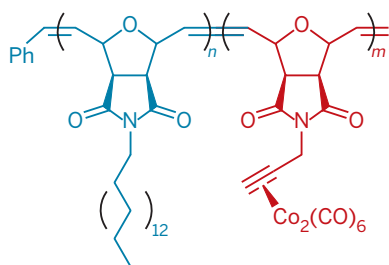
The block copolymer is formed from two types of oxanorbornene monomers. One has an alkyl side chain; the other has an acetylene side chain complexed with dicobalt hexacarbonyl. The researchers used ring-opening metathesis to form the copolymer and then evaporated the carbonyl ligands to generate cobalt particles within the material.

The two types of blocks in the resulting polymer are immiscible and try to separate, but they can't move far because the blocks are covalently tethered together. These interactions form nanosized cylinders containing the cobalt. Tew believes that confinement of the cobalt within these cylinders gives the copolymer its magnetic properties. Conversely, the homopolymer is not magnetic because it forms an amorphous material that lacks the copolymer's nanostructure.

A bit of data could be recorded in each cobalt cylinder by aligning its spin up or down with respect to a magnetic field—assuming a suitably tiny data-recording head could be designed. In that case, Tew told C&EN, "you would be talking about terabytes of data storage per square inch instead of the gigabytes" that can be stored in currently available media.

One advantage of the technique is its adaptability. "We think that what we're doing could be applied to other monomers, as long as you get the nanostructure right," said Tew. —SOPHIE ROVNER

BUILDING BLOCKS Magnetic block copolymer could be used for data storage.



Ph = phenyl