POLYMER CHAINS

The power of two

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The machinery of living organisms is founded on the ability of biomacromolecules to fold and coil. Recently, scientists have begun to explore the possibility of creating artificial systems from synthetic polymers that can fold in a predictable manner. Although nanoparticles have been created by folding linear polymers, it remains challenging to make polymer particles that are comprised of multiple, foldable domains. Raj Kumar Koy and Jean-François Lutz at the Institut Charles Sadron in Strasbourg have now synthesized polymer nanoparticles in which two polymer subdomains fold independently of each other.

The researchers start by devising a foldable single-chain polymeric sequence that contains two chemically distinct parts separated by a polystyrene spacer. Both chemically active sections contain variations of an *N*-substituted maleimide that can undergo intramolecular crosslinking, but in one of the two domains, the maleimide is initially protected by a triisopropylsilyl group. To synthesize the folded nanoparticle, the researchers first induce intramolecular crosslinking in one domain. They then deprotect the second domain, which allows it to undergo intramolecular crosslinking and form nanoparticles with two distinct subdomains. *AM*

SCIENCE COMMUNICATION

Blogging benefits students

J. Chem. Educ. http://doi.org/vt9 (2014)

Successful science careers are based on more than just a foundation in the subject — they require effective communication, leadership and teamwork skills. To improve the ability of graduates to communicate complex topics to technical and non-technical audiences, writing and presentation courses, as well as workshops on communication skills, have been implemented in graduate and undergraduate programmes. In line with such efforts, Robert Hamers and colleagues now show that blogging can increase students' confidence in writing and improve their ability to communicate technical topics effectively to general audiences.

The researchers — who are based at the Center for Sustainable Nanotechnology, a National Science Foundation Center for Chemical Innovation that involves five universities and a national lab — created a multi-author blog to enhance the communication skills of its students, and to increase the interest and improve the knowledge of the public on the science related to sustainability and nanotechnology. Students were free to write on sustainability or nanotechnology topics based on their own work or that of a collaborator. At the start of the project, students were given a seminar on content guidelines, editorial workflow and social networking promotion strategies. To address the students' concerns over the lack of ideas, experience and time, a Center staff member acted as a blog editor. Students proposed ideas to the editor, who then coached them and edited drafts of the blog posts before publication.

After nine months, surveys from focus groups found that students felt that the editorial and peer editing process was useful and that the experience boosted their confidence in writing. *ALC*

SURFACE REACTIONS

High impact

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When a particle hits a catalytic surface, diffusion can no longer be described using Brownian motion because attractive surface–particle interactions begin to play a role. This type of behaviour, which is known as near-wall hindered diffusion, can significantly increase the time the particle spends near the surface and is particularly important for electron-transfer reactions, but studying the effect remains challenging. Enno Kätelhön and Richard Compton at the University of Oxford have now developed a model that could help experimentalists account for this behaviour in their measurements.

The researchers divide the space above a surface into three zones. The layer nearest to the surface is where particles are permanently adsorbed; above that, there is a tunnelling region that defines the distance in which electron transfer can occur; and above that, there is a non-tunnelling region in which no electrochemical reactions can occur, but the particle is still considered to be in the near-wall hindered diffusion regime and is likely to return to the tunnelling region within the sampling time of a single measurement.

Each time a particle enters the tunnelling region, a tiny current is generated at the electrode. The duration of this current, however, can change significantly depending on the size of the particle and the height of the non-tunnelling region. As a consequence, most impacts are too short to be detected by experiments and only contribute to the noise. In order not to lose this valuable information, Kätelhön and Compton recommend that physicochemical parameters are tuned so that the average time spent by a nanoparticle in the tunnelling and non-tunnelling region before it returns to the bulk is on the order of the measurement sampling rate. *AM*

ORGANIC SEMICONDUCTORS

Solving the nuclear issue

Science **345,** 1487–1490 (2014)

Condensed-matter physicists often perform experiments at low temperatures to minimize the undesired effects of thermal excitation. Yet, if the phenomenon being studied has potential practical applications, it can also be important to know what happens at high temperatures. Hans Malissa and colleagues at the University of Utah, the University of Queensland and the University of Regensburg have now studied the effect of nuclear spin excitations in organic light-emitting diodes (OLEDs) at room temperature; these experiments are particularly challenging because at room temperature the nuclear spin excitation is one million times smaller than the thermal energy.

The effects of external magnetic fields on the conductivity of organic semiconductors have previously been attributed to the hyperfine interaction between the nuclear and the electron spins. Malissa and colleagues confirmed this prediction with two types of experiment. In the first, they used a technique known as electron spin-echo envelope modulation to study OLEDs made of the polymer MEH-PPV, and monitored the way in which the current evolves after the electron spin has been excited by a microwave pulse. In particular, they measured a signal modulated by a frequency typical of the hydrogen nuclear spin in the polymer. By replacing hydrogen with deuterium in the polymer the modulation frequency changed accordingly, illustrating that the interaction of the electron spin and the nuclear spin affects the current in these materials.

A more direct confirmation of the effect of the hyperfine interaction came from the second experiment. Here, the researchers used a technique known as electron–nuclear double resonance, in which the current is measured after excitation of the hydrogen nuclear spin with a radiofrequency pulse. Again, a clear modulation of the current was observed. *FP*

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