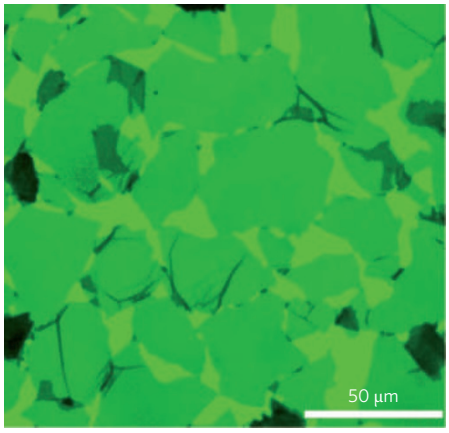
Now, Trevor Douglas and co-workers from Montana State University have used a protein cage as a template to grow particles of an iron-phenanthroline-based coordination polymer. The key to the assembly of the coordination polymer is to link together — inside the protein cage — several units of an already formed iron(II) complex using a copper-catalysed Huisgen cycloaddition between alkynes and azides. The interior of the protein cage has 24 cysteine residues, each of which is functionalized with an alkyne. These are then coupled to the azide groups attached to the phenanthroline ligands of the iron complex.

Alternately adding a trialkyne and more of the iron complex to the protein cage results in the formation of a branched coordination polymer within the protein cage. In the absence of the protein cage, similar reactions lead to uncontrolled polymerization and precipitation of the coordination polymer.

MICROSCOPY

Glowing graphene

J. Am. Chem. Soc. doi:10.1021/ja906730d (2009)



Much effort is being applied at present to making, processing and understanding the properties of graphene — a single layer of sp^2-hybridized carbon arranged in a chicken-wire-like structure. Evaluating samples of graphene after synthesis or manipulation is vital to its study, but present techniques, such as atomic force microscopy (AFM) and scanning electron microscopy, have problems with low-throughput or need vacuum conditions, respectively. Also, present optical imaging techniques require special substrates.

Now, Jiaxing Huang and co-workers at Northwestern University have developed a high-throughput, high-contrast technique — fluorescence quenching microscopy (FQM) — for visualizing graphene, graphene oxide and reduced graphene oxide sheets on arbitrary substrates. The method involves spin-coating the sample with a solution of fluorescein in ethanol and polyvinylpyrrolidone, and relies on the fact that graphene materials strongly quench the fluorescence of nearby dye molecules. Once coated, the sheets can be visualized using a fluorescence microscope, and they appear darker than the background substrate. The researchers use AFM to confirm that, after evaluation, the dye coating can be washed off using ethanol or water without damaging the sample.

The technique can also image graphene materials in solution, unlike conventional techniques. Huang and colleagues took 'snapshots' that showed almost in real time how graphene oxide sheets were deposited during a drop-casting process, explaining why sheets made using this method are often crumpled.

NUCLEOPHILIC CATALYSIS

Fast fused rings

Angew. Chem. Int. Ed. **49,** 161–163 (2009)

In the design of new synthetic organic reactions, those that can create multiple carbon–carbon bonds and stereocentres in the same reaction are of great interest. Such rapid generation of molecular complexity from simple precursors is useful in building the types of structure widely found in biologically active natural products and drug molecules.

Now, Gregory Fu and co-workers from the Massachusetts Institute of Technology have reported a phosphine-catalysed reaction that forms two rings, three contiguous stereocentres and an *E*-alkene isomer double bond from a linear substrate. Conjugate addition of the phosphine catalyst to an ynone first generates a zwitterionic enolate. A second conjugate addition of this enolate to a pendant α,β-unsaturated ester generates a second enolate and forms the first ring and two stereocentres. This second enolate reacts with the original ketone to close the second ring and elimination of the phosphine generates the alkene. The reaction has been used to generate several examples of 5,5-fused-ring systems and, so far, two examples of a 6,5-fused-ring system — structures that are found in several natural products.

Fu and co-workers now hope to develop an enantioselective version of their reaction and the initial results are promising. Despite the phosphine being a relatively long way from the carbon–carbon bonds that are formed, a first attempt using a chiral phosphine resulted in a 60% enantiomeric excess without any further optimization of the reaction conditions.

The definitive versions of these Research Highlights first appeared on the *Nature Chemistry* website, along with other articles that will not appear in print. If citing these articles, please refer to the web version.

blogroll

Take a deep breath

Chemistry expertise is not necessarily required for jurors, and if you're looking for a job, it helps if you've already got one.

A chemistry degree is a passport to many things, but did you ever think that it might get you out of jury service? Well, that's what happened to Vastib, as he outlined on a post on the Chemistry Blog (http://tinyurl.com/yhtofgs). He was summoned to perform jury duty in a driving-under-the-influence case and "one question asked by the defense sparked my attention. The attorney asked 'Does anyone know how breathalyzers works?'" Vastib then explained the clever use of electrochemistry, where the ethanol in your breath is oxidised to acetic acid in a well-defined four-electron process. The measured current is then used to calculate the level of alcohol in the exhaled breath. He was then asked whether he could "leave his expertise at the door and make his decision based only on what is presented by witnesses called during the trial" and if he would be able to ignore his own misgivings if he thought the expert testimony was wrong. As he could not, he was dismissed as a juror. He asked readers to consider whether they can turn off their critical thinking on request — most didn't think they could, or should.

Mad Chemist Chick made an interesting observation in her post "Jobs are like boyfriends" (http://tinyurl.com/y8ow2ql). She quickly explained that: "It is easier to find one when you already have one." This old adage was reflected in her own experience: it took 18 months to find "the right job" after a postdoc, but in her present search had a job interview fall into her lap. The ACS Careers blog has some advice on how to avoid being caught in this "Job market version of Catch 22" (http://tinyurl.com/ydfb7r8).

And finally, we'd love to add Blogroll's weight to Chiral Jones's campaign for a chemistry reality show. Who wouldn't like to see America's Next Top Chemist? His other idea (http://tinyurl.com/yde7p7f) is MTV: Labs, with people showing off their equipment, copying MTV Cribs complete with 'inside the hood' shots.