MATERIAL WITNESS

Materials matchmaking

In the ideal equilibrium market considered by traditional economics, supply always matches demand and products always find their way to the consumers who want them. This 'market-clearing' situation is often absent in the real world, but to judge from the discussion at a recent seminar*, the materials market is particularly prone to such inefficiency.

I don't mean whether the construction industry in China can satisfy its voracious appetite for cement and steel, but rather, whether a designer in Manhattan or Milan can find the material she needs for a theatre set or a new apartment. How do the people who want to use new materials on a modest scale even begin to survey the vast and daily-expanding array of choices to find the one that meets their needs?

At present this is a haphazard process. But designers, architects and others do not have to wander alone through the maze of new materials. There are people out there who can guide them. The UK has the Materials Knowledge Transfer Network (http://www.materialsktn.net), part of which, the Materials and Design Exchange (MADE; http://www.iom3.org/MADE/) specializes in matchmaking producers and consumers. And at the seminar, Margaret Pope discussed the challenges of running her London-based consultancy to identify and source materials for clients.

It's not easy to create these marriages. MADE's Sumeet Bellara explained that people unfamiliar with materials properties don't always know quite what they want. Although a request for 'something squidgy' is enough to make a start, this may not be an exhaustive or even prioritized description of what is really required — the material might also need to be tough and odourless, say. And Bellara said that some requests for problem-solving materials turn out to be motivated by factors that no material will solve.

Often the best way for consumers to get literally to grips with what is on offer is to have direct, experiential contact with materials — not just to address existing problems but to find new ideas. The Materials Research Group at King's College London maintains a materials library that provides "an intellectual and sensual intersection between the arts and sciences" — a place where anyone can experience the astonishing fabrics now available, from aerogels to thermochromic bricks.

Yet the qualities, and thus the design potential, of a material may depend not only on bulk quantifiers of performance, but on, say, size and shape. Can one judge the architectural impact of a fabric from a postcard-sized swatch? This is a difficult issue for materials librarians.

Satisfying consumers' demands is only half the problem. Pope said that manufacturers are often conservative, wary of supplying a material for uses different from that for which it was originally conceived. "Oh, we don't work with designers" is a common response. Overcoming this resistance may require a lot of face-to-face persuasion and reassurance, Pope explained. It's not surprising, then, that new materials are probably only finding a fraction of their potential applications.

Philip Ball

**New Materials, New Technologies: Innovation, Future and Society* Kings College London seminar series, 12 May 2008.

POLYMERS

Facing the flip side

A blend of ferroelectric and semiconducting polymers provides a potential route to a memory technology compatible with low-cost printed electronics.

J. Campbell Scott
is at the IBM Almaden Research Center, San Jose California 95120, USA.
e-mail: jcscott@almaden.ibm.com

When personal computers first appeared on the market, for about $100 you could buy a 10 MB hard-disk drive, or you could have dinner for six in a nice restaurant. Three decades later, that $100 will purchase a disk-drive approaching 1 TB, or a 16 GB flash memory card, or perhaps dinner for two. The flip side of this economic version of Moore's Law is that to take advantage of the enormous decrease in the price of data storage, you must buy a disk-drive or a flash-card with capacity not much less than those than those described above. On the other hand, you need not take ten thousand of your closest friends to dinner. On page 547 of this issue, Kamal Asadi and co-workers report on a memory device that may provide a route to low-cost data storage for much smaller volumes of data[1].

The concept behind their memory element is to combine two polymers that have distinct roles in its operation: a ferroelectric polymer provides the binary state and data retention whereas a semiconducting polymer provides the means to probe that state via an electrical signal. The ferroelectric polymer is chemically very similar to the material used in headphones and modern audio speakers, where the piezoelectric properties are exploited. In the memory device of Asadi *et al.*, the polymer backbone is modified to lower the coercive electric field to enable easier reversal of the polarization. The polarization is stable at the low electric fields required for readout. The semiconducting polymer is a hole-transporting material that has been extensively investigated for use in organic solar cells. The electric field applied during readout drives electric current through the conducting phase of the polymer blend by injecting holes from the positive electrode (Fig. 1). When the ferroelectric polarization points away from the injecting electrode, charge injection is enhanced by at least an order of magnitude compared with when it points in the opposite direction. When one of the electrodes is made to block injection altogether, the device is a rectifying