R&D Magazine Blogs

Lunar tires, space MRSA, and resonating microfluidics

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I typically attend the annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy each year in pursuit of specific coverage. This year, I sought out candidates for coverage in a vacuum technology article, and pulled together some instruments for a spectroscopy guide. As the pre-eminent spectroscopy and analytical event in the U.S., then, I was in the right place at the right time.

But as busy as that kept me, it wasn't all mass spectrometers and vacuum pumps on the show floor. This a high-technology crossover show, and lab equipment mixes with optics, software and various interesting testing systems to create an environment where the creative spirit shines through. As a result, there were some neat toys and head-scratching surprises.

Moving with the Flow

The world of rheology instrument vendors is a narrow one, probably numbering less than the fingers on a single hand. But industries that require rheological data are probably tough to count. Even a single materials typeð powdersð are ubiquitous. Brookfield Instruments, a long-time player in this field, has come up with a solution in its Powder Flow Tester. Robert McGregor helped explain this deceptively simple device, which was designed first for the food industry. Its design and cost helped it become a popular tool in other industries, and now pharma is using it.

The key parts of the tester include a trough and a vaned lid that move in a circular pattern until a certain torque is produced by the vertical vanes as they slide against the powder. The slippage lets the machine gauge viscosity and accurately simulatesð within a small sampleð the physical conditions encountered by the typical industrial powder hopper.

On the Moon. Or an asteroid. Or Mars.

The NASA booth wasn't really a booth, it was more like a courtyard. And they're featured ñproductòwasn't really a product, it was a prototype. The agency, of course, doesn't sell analytical devices, but almost every spacecraft they have ever launched has carried a spectrometer on board. So it's understandable they'd want to show off one of their latest concepts for an extraterrestrial analytical platform: the Scarab. Designed with the input of engineers at Carnegie Mellon, the small four-wheeled rover was unique in that the wheels were articulated front-to-back, allowing the vehicle to shorten or lengthened its wheelbase to aid maneuverability and traction, particularly on the steep slopes of crater walls. Featuring unique weaved wire wheels, the buggy is intended to examineð on-siteð the same lunar soil that LCROSS recently revealed contained significant amounts of organic volatiles, namely water.

Biotech in orbit

Low-gravity environments are excellent for crystal-based materials research in part because the lack of gravity allows faster growth. Tom Pickens, CEO of Astrogenetix, a biotech startup out of Texas, took note of successes made in this area of R&D and decided to try capitalizing on the knowledge that cell cultures

also had the same predilection for rapid growth when unencumbered by terrestrial hindrances like gravity or convection.

Relying on the space shuttle platform, Pickensôcompany successfully ran a program for the development of a salmonella vaccine that is now going through FDA trials. That set the stage for the next vaccineð MRSA. Conducting cell trials on a virus as potentially deadly as MRSA in the confined spaces of the International Space System may seem foolhardy, but Pickens says his biggest worry is how his experiments will run after the space shuttle is grounded. Having lost the battle to keep the program alive, he is now looking for alternatives. One stage of his MRSA effort was on board the latest Endeavor mission.

Of course, Astrogenetix and its parent company, Astrotech, had little more than a mass spectrometer on display at the show. But I expect the union of microgravity and biotech will spread to the strategy portfolio of other adventurous R&D outfits, and that weôll be hearing more from Astrogenetixð assuming, of course, they can find someone to carry their experiments to the ISS.

Sizing up a tiny situation

Whatôs the best way to gauge the size of a nanoparticle? Itôs typically inferred by a variety of analytical methods, but finding an exact measurement is exceedingly difficult and often requires laborious sessions with a transmission electron microscope.

If Ken Babcock at Affinity Biosensors is right, his companyôs particle characterization instrument, Archimedes, will greatly simplify that effort for anything down to 10 to 15 nm in size. The non-optical machine uses a concept that emerged from bio-MEMS research at MIT: a microfluidic channel, cut into the broad side of a microscopic resonant single-tine fork, carries particles along to the end of the fork and back. The fork resonates to frequency, and minute changes in that frequency can be mapped back to particle size when also accounting for volume and density.

As Matt Wilkinson at RSC alerted us earlier this week, the Archimedes has the kind of technology to be an award-winning. Indeed, Pittcon officials later christened it with the showôs Gold Award. Better yet, NIST is examining the device as potentially providing them with a traceable standard for nanoparticle size.

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