# Micro-onions and magnetic ink

August 8 2011

(PhysOrg.com) -- Microfluidic systems for the easy production of multiphasic emulsion drops and multishelled polymer capsules. Under a microscope they look like miniature onions, in fact, they are new microcapsules introduced by David A. Weitz and Shin Hyun Kim in the journal Angewandte Chemie.

The researchers from Harvard University in Cambridge (Massachusetts, USA) have developed a simple method that makes it possible to produce these tiny shell-like objects with a microfluidic system in just one step. Possible applications include magnetic inks and transport systems for multicomponent pharmaceuticals.

By using a sophisticated microfluidic system that consists of multiple glass capillaries with water-repellent and water-attracting coatings, the researchers are able to get opposing streams of immiscible liquids (oil and water) to collide. Tiny droplets are formed as the resulting stream passes through an opening into a collection capillary. Within the droplets, the phase boundaries between the liquids are cleverly disrupted so that—depending on the structure of the system—three- or four-layer emulsion drops are formed. This process is the first to make it possible to produce large numbers of multiwalled emulsion drops of uniform size and structure.

As a sample application, Weitz and Kim produced a “magnetic ink” for displays. The oily phase was a solution of a UV-crosslinking polymer. The researchers produced emulsion drops with a core of polymer solution surrounded by a shell of water, which is in turn contained in

another shell of polymer solution. They mixed magnetic particles and black pigments into the polymer solution that makes up the core and added tiny particles of plastic to the aqueous liquid. After irradiation with UV light, they obtained transparent capsules with a solid shell and a solid, black core that floats freely in the aqueous layer with the plastic particles. In the absence of a magnetic field, the black cores remain at the center of the capsules. A layer of such capsules in a display appears white because the plastic particles scatter light. When a magnetic field is applied, the cores are pulled toward the surface of the display, making the black color visible.

Another practical application for multilayer capsules is the transport of multicomponent pharmaceuticals that would remain separate until sequentially released on target in the body.

**More information:** *Angewandte Chemie International Edition*, DOI: 10.1002/anie.201102946

Provided by Angewandte Chemie