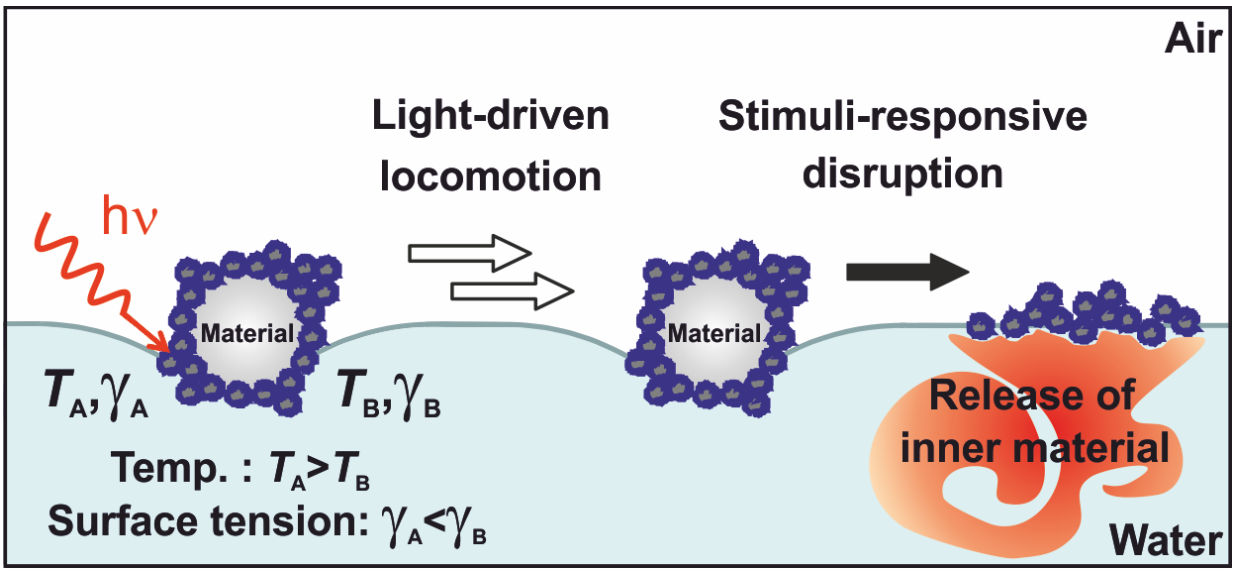
# Liquid marbles can be caused to move with laser light (w/ Video)

April 14 2016, by Bob Yirka




Scheme illustrating the light-driven delivery of material using liquid marbles (LMs). Credit: © WILEY-VCH (2016)

(Phys.org)—A team of researchers with Osaka Institute of Technology in Japan, has developed liquid balls that propel themselves when exposed to laser light. In their paper published in the journal *Advanced Functional Materials*, the team describes how the liquid balls are made, how they can be used and some possible applications for them.

The idea for the liquid balls came, the team reports, from noting how

Stenus beetles propel themselves across the surface of the water—when alarmed, they emit a droplet of stenusin from their anal gland, which causes a change in surface tension behind them, pushing them forward. In this new effort, the researchers used a nanometer-scale powder of polypyrrole (a type of plastic) to accomplish much the same thing—when exposed to light, it heats up and expands.

To make the balls, or liquid marbles, as the team calls them, the researches coated very small drops of water with the plastic. Like the Stenus beetle they float on the surface of the water and also like the beetle, they can be propelled by a change in surface tension behind them—in this case, that comes about by laser light—as the light strikes, the plastic heats up and expands, causing a change in the surface tension on the water behind the marble, which causes it to move forward. The team found that the marble had strength as well—they rigged up a floating apparatus that hooked onto one of their marbles, then shone the light, and in so doing, discovered that the marbles could pull floating structures that weighed up to 150 times more than they did. It is worth noting, the team points out, that the laser does not push the marble, instead it causes a chemical reaction that results in the marble moving.

And that was not all, they also found that if they blasted the marble long enough with the laser, they could cause it to burst on demand. That means, the team explains, that the marbles could be used as both a transport and delivery mechanism—a service that could find applications in pollution detection, delivery of drugs inside the body, microfluids and even micromachinery.

**More information:** Maxime Paven et al. Light-Driven Delivery and Release of Materials Using Liquid Marbles, *Advanced Functional Materials* (2016). DOI: 10.1002/adfm.201600034

## Abstract

Remote control of the locomotion of small objects is a challenge in itself and may also allow for the stimuli control of entire systems. Here, it is described how encapsulated liquids, referred to as liquid marbles, can be moved on a water surface with a simple near-infrared laser or sunlight. Using light rather than pH or temperature as an external stimulus allows for the control of the position, area, timing, direction, and velocity of delivery. This approach makes it possible to not only transport the materials encapsulated within the liquid marble but also to release them at a specific place and time, as controlled by external stimuli. Furthermore, it is shown that liquid marbles can work as light-driven towing engines to push or pull objects. Being able to remotely transport and push/pull the small objects by light and control the release of active substances on demand should open up a wide field of conceivable applications.