A light-powered hydrogel launcher

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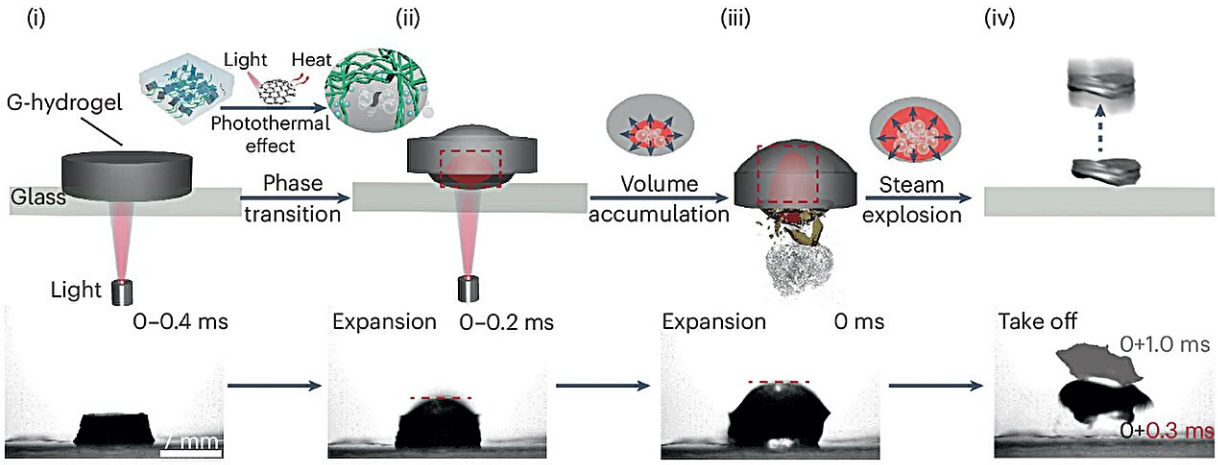

Schematic of the ASEF mechanism and high-speed camera images showing the take-off from a glass substrate. Credit: *Nature Materials* (2024). DOI: 10.1038/s41563-024-01955-4

An international team of mechanical engineers has developed what they call a fracture-driven, power-amplified hydrogel launcher. They have published their discovery in the journal *Nature Materials*.

In robotics, some tasks require quick propulsion, such as jumping, ejecting materials or even catapulting materials from one place to another. They are typically made by creating robots that pre-store energy and let it go, like a spring.

Most of these robots use chemical or elastic energy, which have limitations, mostly due to low energy. In this new effort, the researchers developed a launcher based on a new type of propulsion source that has more energy.

The researchers noticed that a squirting cucumber plant employs a fast liquid vaporization triggering system to shoot seeds out when ripe—it builds up pressure inside gradually over time, then suddenly releases it, forcing the seeds into the air. Inspired, they decided to make their own version.

After much trial and effort, they found that embedding a piece of graphene in a hydrogel disk was suitable for the task. Firing a laser at the disk heats the graphene, which in turn heats water sealed in the hydrogel, converting it to steam. Eventually, a fracture point develops and the steam is released out of a central point in the bottom of the disk. That makes the entire disk shoot up into the air.

In their experiments, the disk had a diameter of 7 mm and a thickness of 3 mm. Testing showed that it was capable of launching itself into the air up to 1.93 centimeters. The team claims it outperformed all other types of launchers/jumpers.

The team believes their launcher could serve a variety of purposes, including deep tissue sampling. They tested their launcher by holding it still and allowing the steam bursting out the bottom to push seeds partnered with an RFID device into the soil to create a smart seed bed. They also note that larger disks could conceivably be used in ballistic weapons applications.

More information: Xin Wang et al, Fracture-driven power amplification in a hydrogel launcher, *Nature Materials* (2024). DOI: 10.1038/s41563-024-01955-4