

Research Highlights

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Flexible Patterning on Liquid Marble Droplets

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A team at MANA has created flexible patterning of functional particles on liquid marble droplet surfaces in a patchwork design. Their results show that these droplets can switch their macroscopic behavior between a stable and an active state on super-repellent surfaces in situ by jamming and unjamming the surface particles.



Solid particles in the nanometer to micrometer size range irreversibly attach to liquid surfaces, which has led to new products and concepts, such as powder foam, dry water and liquid marble (LM).

LMs consist of droplets wrapped by hydrophobic solid particles, which behave as a non-wetting soft solid. Thanks to this property, LMs have applications in fluidics and soft devices, and a wide variety of functional particles have been synthesized to form functional LMs. However, it is difficult to form multifunctional LMs by integrating several types of functional particles.

Active LMs hydrostatically coalesce to form a self-sorted particle pattern on the droplet surface. With the support of LM handling robotics, on-demand cyclic activation-manipulation-coalescence-stabilization protocols by LMs with different sizes and particle types result in the reliable design of multi-faced LMs. Based on this concept, the MANA team designed a single bi-functional LM from two mono-functional LMs as an advanced droplet carrier.

The team showed that they can switch LMs' macroscopic behavior between solid and liquid in situ by changing the packing density, whereas most materials require thermal energy and/or pressure to enable switching.

While jamming particles to prepare droplets with solid-like behavior has been studied in the past, the concept of a reversible interfacial jamming transition at the fluid-fluid interface to activate/stabilize LMs offers a new platform for the development of colloidal and soft matter science.

The team believes this property may be of great interest to materials science researchers.

This research was carried out by [Mizuki Tenjimbayashi](#) (MANA Independent Scientist, WPI- MANA, NIMS) and his collaborators.

Reference

"Liquid Marble Patchwork on Super-Repellent Surface"

[Mizuki Tenjimbayashi](#), Sadaki Samitsu, Yuko Watanabe, Yasuyuki Nakamura, Masanobu Naito
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Affiliations

International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Namiki 1-1, Tsukuba, Ibaraki 305-0044, Japan

Contact information

International Center for Materials Nanoarchitectonics(WPI-MANA)

National Institute for Materials Science

1-1 Namiki, Tsukuba, Ibaraki 305-0044 Japan

Phone: +81-29-860-4710

E-mail: mana-pr@ml.nims.go.jp