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Liquid marble engineering: From nature to materials

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Liquid marbles (LMs) are liquid droplets stabilized by solid particles adsorbed at the gas-liquid interface. LMs can be artificially fabricated by coating the liquid droplets with hydrophobic solid particles and can move easily on various solid surfaces because of their nonwetting nature. Here, I will give a talk on our recent research related to LMs that are stabilized solely with functional particles [1].

Liquid marbles in nature: Craft of aphids for survival [2]

Some aphids that live in the leaf galls of the host plant are known to fabricate LMs consisting of honeydew and wax particles as an inner liquid and a stabilizer, respectively. The LMs fabricated by the galling aphids, *Eriosoma moriokense*, were extensively characterized from the perspective of physical chemistry.

Shape-designable liquid marbles [3]

A new type of armored droplets, so-called polyhedral LMs are introduced. The polyhedral LMs consist of liquid droplets stabilized by hexagonal plates made of poly(ethylene terephthalate), which adsorb to the liquid-air interface. Depending on the specific combination of plate size and droplet diameter, the plates self-assemble into highly ordered hexagonally arranged domains. Even tetrahedral-, pentahedral-, and cube-shaped LMs composed of only 4 to 6 plates are demonstrated. Highly asymmetric and super-long polyhedral LMs and letters are obtained due to the strong interfacial jamming exerted by the rigid hexagonal plates.

Fig. 1 Initials of the term polyhedral LM: PHLM, formed using transparent 2.35 mm-sized plates and dyed water. LMs with different polyhedral morphologies. SEM image of a dried cyanoacrylate-treated 3 μL polyhedral LM using 0.34 mm-sized plates.

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