**Multi-stimuli-responsive liquid marbles for miniature reactors**

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Liquid marbles (LMs) were first reported by Aussilous and Quéré in 2001 to realize the microfluidic motion without wetting solid surface1 and this has attracted increasing research interest.LMs prevent the contact of encased liquid inside with supporting plan so that the problem of surface contamination is avoided and surface friction is significantly reduced.As a new approach to manipulating liquid, LMs can be driven by external forces, such as gravity, electricity,light,based on the liquid or component attributes; However, most LMs reported, as far as we are aware, respond to a single external stimulus only with limited prospects.The formation of LMs triggered by various stimuli is important for its potential application, which, however, are still problematic.LMs used as droplet reactors have also been adopted recently due to the advantages of compartmentalization, miniaturization, mono-dispersity, and high throughput, which can reduce the use of chemical reagents and solvents with confined micro-environments and controllable reaction conditions. However, existing research almost is based mainly on the static properties of LMs without turbulent mixing, or basically perform LM-based microreactions with the encapsulation of all reagents in an individual reaction system; this limits the performance of LMs as microreactors, since mass transfer and molecular mixing are crucial for chemical engineering processing. The interactions between LMs vary depending on the properties of the coating particles and liquid encapsulated within them, particularly. LMs coalescence is one of the most essential manipulation schemes to functionalize microfluidics with an application like micro-mixing and microreaction. When two LMs are placed in contact, they will not coalesce naturally even pressed against each other. However, the surface deformation during collision will convert the kinetic energy to an accumulated impetus for triggering and even intensifying reaction processes. A number of techniques have been reported to collide LMs such as magnetic force and DC voltage. However, the coalescence that intensifies a microreaction in LMs is rarely reported. In this talk, we report a set of LMs which were multi-stimuli-responsive to light, electricity, ultraphonic and magnetism. Therefore, LMs-based microreactors can be manipulated in different ways accordingly. The effects of drop size and collision on both reaction rate and nanomaterials size were investigated by both theoretical calculation and experimental studies. This work opens the way to for expand the functions of LMs, and offers analysis tools to study the mechanisms of micromixing in a large variety of applications.