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Mechanism, Manipulation and Application of the Bubble Micromotor

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ABSTRACT

The emerging technique of artificial micro/nano-motors [1] provides a vivid example of the idea using tiny machines to finish jobs in microscopic world. Among many micro/nano-motors, microbubble driven micromotor is a unique type that can reach the highest propulsion speed [2, 3], owing to the high surface energy of the bubble and the focused hydrodynamic jet during bubble collapse that can significantly enhance micromotor's propulsion. Recent progress has demonstrated that the microbubble itself can implement new functions for the micromotor based on bubble dynamics and induced hydrodynamic flow, rather than merely providing energy. For instance, bubble microrobot has been developed to realize functions like gripper, pusher, and anchor [4]. In fact, more functions can be extracted from the sophisticated mechanisms when microbubble is involved. Specifically, microbubble collapse and its induced hydrodynamic impact provide a transient inertial effect which is precious in microscopic world. More importantly, the inertial effect offers a possibility to detect physical quantities in microscale, which is closely related to inertia but very difficult to measure by existing methods. Bubble microrobot could provide an alternative approach probing the mass or density of a tiny particle by its response to inertial impact, with merits like controllable single particle selection and real-time measurements.

KEYWORDS

Bubble dynamics; micromotor; magnetic actuation; mass measurement

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