PROCEEDINGS of the
23rd International Congress on Acoustics

9 to 13 September 2019 in Aachen, Germany

Acoustic Holograms for Particle Assembly and Fabrication

Kai MELDE[1,a]; Zhichao MA[a]; Korbinian POEPPEL[a]; Peer FISCHER[2,a,b]

[a] Max Planck Institute for Intelligent Systems, Stuttgart, Germany

[b] Institute for Physical Chemistry, University of Stuttgart, Germany

ABSTRACT

One established field of research for ultrasound is the contact-free manipulation of particles and cells. Its non-toxic nature, paired with the low absorption in aqueous environments, offers potential avenues even in the biomedical field. Ultrasonic manipulation techniques can be divided into assembly schemes that trap particles in elongated regions, and tweezing approaches that trap single in a localized point. Conventional assembly methods rely on resonant structures, which are inherently symmetric and thus limit the attainable structural complexity. Tweezing methods, on the other hand, must actively reposition the trap to move a particle, either by moving the transducer or by reconfiguring a phased array transducer. Acoustic holograms, however, allow to control sound fields with high fidelity and can be used to create both extended potentials and tweezer-like traps (1, 2). Holograms can be implemented on phased array transducer or using 3D-printed elements. The latter allows several orders of magnitude more degrees of freedom in the design at virtually no added cost, which allows to explore more advanced particle manipulation techniques. In this talk, I will give an overview over acoustic holography and its use for microparticle assembly, rapid fabrication and I will highlight new developments.

Keywords: acoustic hologram, particle manipulation, acoustic fabrication

REFERENCES

1. Melde K, Mark AG, Qiu T, Fischer P. Holograms for acoustics. Nature. 2016;537(7621):518-22.
2. Melde K, Choi E, Wu Z, Palagi S, Qiu T, Fischer P. Acoustic Fabrication via the Assembly and Fusion of Particles. Adv Mater. 2018;30(3):1704507.

[1] melde@is.mpg.de
[2] fischer@is.mpg.de