Manipulate nanoparticles with a laser-induced microbubble

Yuwen Li,[1,*] Chenglong Zhao[1,2,#]
[1]*Department of Electro-Optics and Photonics, School of Engineering, University of Dayton, 300 College Park, Dayton, Ohio 454469, USA*
[2]*Department of Physics, College of Arts and Sciences, University of Dayton, 300 College Park, Dayton, Ohio 454469, USA*
[*]*author: liy096@udayton.edu*
[#]*author: czhao1@udayton.edu*

Abstract: A laser-induced microbubble refers to a bubble that is generated in a liquid solution by CW laser illumination to light absorptive materials. In this study, we use the gold nanoparticles solutions and gold nanoparticle film as the materials to absorb the heat under illumination. Heat transfer from the gold nanoparticles to surroundings induces a sharp increase in temperature, which results the generation of the microbubbles in the solutions. Therefore, the size and position of the surface bubble can be dynamically adjusted by changing the power and position of the laser spots. Convection currents around microbubble can make the gold nanoparticles pinned to the substrate surface, which can generate the Roman ring-shape structure. And then shine the CW laser of different power on the structure, the characteristics of the structure can be changed. These effects can be used for a wide variety of applications including micro/nano-particle manipulation, active microfluidic control, as well as cell stretching and sorting.