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Optical Force-Deposited Nanoparticles the Necessity for Photothermal Surface Bubble Nucleation in Nanoparticle Suspension QIUSHI ZHANG, RUIYANG LI, EUNGKYU LEE, TENGFEI LUO, University of Notre Dame — We study the mechanism of surface bubble nucleation in nanoparticle (NP) suspension upon laser irradiation. Our experiments find the bubble nucleation thresholds differ depending on if the surface is forward- or backward-facing the light propagation direction. High speed videography reveals that the optical dispersive force-driven NP deposition on the surface is a pre-requisite for bubble nucleation. Optical pulling force is needed to deposit NPs when the surface is backward-facing, and this is achieved only when the laser optical fluence is sufficiently high to generate a supercavitating nanobubble around the NP. When the surface is forward-facing, optical pushing force, which exists on both bare or supercavitating NPs, makes the NP deposition easier and thus lowers the surface bubble nucleation threshold. The results reveal interesting physics leading to photothermal surface bubble generation in NP suspensions.

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