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Self-Positioning Optically Trapped Microspheres For Nanoscale Laser Direct Write CRAIG ARNOLD, EUAN MCLEOD, Princeton University — We present a novel method of near-field laser direct-write patterning by incorporating self-positioning optical manipulation of polystyrene microsphere combined with pulsed laser processing. A 532 or 1064 nm CW laser optically traps a water-dispersed microsphere against a polymer substrate using a 2-dimensional Bessel beam trap. The optical scattering force due to the Bessel beam in the propagation direction is balanced by the repulsive interaction near the surface thereby creating an equilibrium spacing between the two, regardless of large scale surface features. A pulsed nanosecond 355 nm laser directed down the same beam path, is then used to ablate or modify the surface below the microsphere. While the pulsed laser has a large spot diameter, the intensity required for material modification is only achieved directly below the sphere due to focusing and near-field enhancement. Using an x-y translation stage, we demonstrate the ability to move the substrate while keeping the bead fixed in the optical trap, but allowing it to maintain its position above the surface. Direct-write nanoscale features are thereby enabled through this process. Characterization of the resulting structures along with advantages and limitations of this technique will be discussed.

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