The Hybrid Electrothermoplasmonic Nanotweezer: Shaping the Future of Nanomanipulation

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Introduction

Optical trapping was invented by Arthur Ashkin at Bell Labs and have proven useful for manipulation of microscale objects and for ultrasensitive force measurements.

Limitations of Optical Tweezers:
• Does not enable high resolution particle trapping due to diffraction-limited trapping potential well
• Require relatively high laser power for stable particle trapping

To address the aforementioned issues, Plasmonic Tweezers were developed
• Plasmonic nanoantennas can efficiently couple to propagating light to generate highly localized and enhanced electromagnetic field in the vicinity of the nanoantenna
• The enhanced and localized field provides strong optical gradient force and tight trapping potential well for stable trapping and confinement of nanoscale objects

Limitations of state-of-the-art Plasmonic Tweezers:
• Transport of particles to the plasmonic hotspots is slow and driven by Brownian diffusion.
• There is also the problem of loss of dynamic control of particles to be trapped.

To address these limitations, we introduced a novel nanotweezer known as the Hybrid Electrothermoplasmonic Nanotweezer (HENT)

Hybrid Electrothermoplasmonic Nanotweezer (HENT)

Features of HENT
• Rapid and precise delivery of nano-object to plasmonic hot-spots
• Complete control over particle dynamics

References:

Conclusion

We have developed a novel paradigm for nanomanipulation known as (HENT) that enables:
• on-demand rapid and directional delivery of particles to the plasmonic hotspot(s) in the vicinity of a single illuminated plasmonic nanoantenna where they are trapped
• particle trapping in dilute media
• printing of nanoparticles on plasmonic hotspots

HENT would benefit a wide range of applications including bio-sensing, surface-enhanced spectroscopies, non-linear optics and quantum photonics

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