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Bubble-Assisted Laser Tweezers Raman Spectroscopy

Abstract: Raman Spectroscopy has been used for selective and sensitive detection of biomolecules for the last decade [1]. The development of Laser tweezers enables the nanoparticles to push against the wall of a microfluidic chamber to form strong SERS active clusters of nanoparticles. Obtaining Raman signals by trapping nanoparticles and controlling their activity through spatial assignment is known as Laser Tweezers Raman Spectroscopy (LTRS) [2]. A periodic array of such clusters can be designed by generating bubbles precisely focusing the laser on the glass substrate, known as bubble pen lithography (BPL) [3]. But, strong photoluminescence from the glass surface becomes much more prominent which debarred to obtain the Raman signal from a probe. This can be minimized by enhancing the plasmonic interaction between the gold nanoparticle and the substrate containing graphene oxide (GO) giving rise to a more intense SERS signal. In this context, we develop a new SERS substrate by electrospinning a polymer GO composite on glass/ quartz. We use this polymer surface to grow gold clusters with BPL. Now shining on the individual clusters with the Raman laser, we have an exceptional increase in the SERS signal, leading to greater sensitivity. In essence, the work demonstrates an elegant combination of BPL with LTRS to develop a sensitive technique to detect biomolecules in a very subtle amount.

References

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[3] Lin, L.; Peng, X.; Mao, Z.; Li, W.; Yogeesh, M. N.; Rajeeva, B. B.; Perillo, E. P.; Dunn, A. K.; Akinwande, D.; Zheng, Y., Nano Lett. 16 (2016), 701–708.

Figures

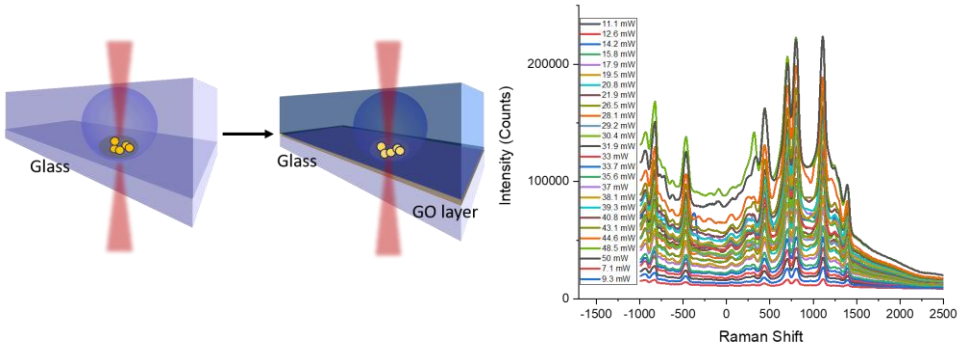

Figure 1: Bubble-assisted LTRS: A method to obtain systematic SERS response