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GC-MS to GC-NOMS: A step towards portable analysis

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The Gas Chromatography (GC) –Mass Spectrometer (MS) system is the industry benchmark in research and chemical analysis. However given that MS systems are large and complicated instrumentation, chemical analyses have a long turnaround time. In this regard, portable GCs have carved a market niche but they have poor sensitivities. Recent demonstrations with Nanooptomechanical (NOMS) resonators at atmospheric pressure have proven that these kind of sensors have the breakthrough potential to improve the sensitivity of portable GCs. In this regard we have built an experimental rig to integrate the GC system with our NOMS device. The goal of this study is two-fold. One will be to replace the GC sensor with NOMS devices, integrate with the portable GCs for better sensitivity, and ultimately match the analytical power of conventional GC-MS. The other will be to demonstrate the NOMS sensing capabilities for next generation genomic applications like personalized medicine. In this regard, we have designed and developed a free space interferometry system. The probe laser is coupled in and out of the photonic waveguide using grating couplers. Using the evanescent field of the waveguide, the shift in resonant frequency of the nanoscale resonators is recorded using lock in amplifier. Here we have tracked the response of both the ring resonators using the photodetector output and the nanomechanical resonator using the phase locked loop (PLL). GC peak sensing can be done with either or both of the mechanical and the photonic sensors. During the initial testing with analyte standards we observed the ring resonator to respond faster than the nanomechanical resonator on par with the GCs flame ionization (FID) detector. We were also able to capture the analyte peaks effectively with the sensitivity of the resonators to be about 77 zg/Hz.

Author: Dr VENKATASUBRAMANIAN, Anandram (Post Doctoral research fellow)

Co-authors: Mr ROY, Swapan (Graduate Student); Dr SAUER, Vince (Graduate Student); Dr HIEBERT, Wayne (Research Officer)

Presenter: Dr VENKATASUBRAMANIAN, Anandram (Post Doctoral research fellow)

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