KWJ ENGINEERING INC
INNOVATIVE SOLUTIONS FOR GAS DETECTION

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Low Power Nano-Sensor Based Measurement of Atmospheric Nitrogen and Argon | DOE Phase I SBIR, Award No. DE-SC0011263

Need: This proposal responds to DOE's effort to develop technology which will become the foundation of the next generation of eddy covariance. Not only are measurements of such fluxes crucial in the research fields of climate change, global change biology, and ecology, but they also have direct applications in agriculture, medicine, and industrial processes.

Ultralow power, ultrafast responding "nanoTCD" gas sensors will revolutionize real time measurement of atmospheric N2 and Ar, in conjunction with greenhouse gas flux observations.

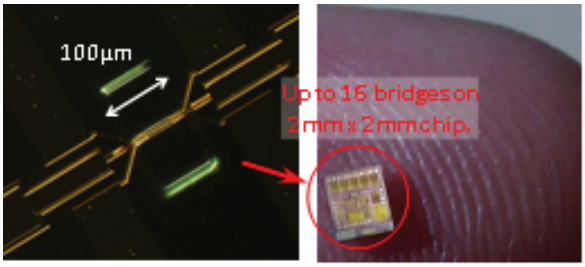

Figure 1: (a) Example MEMS bridge and chip package fabricated by KWJ in prior work. (b) Up to 16 of the 100x2µm bridges are fabricated in a single chip.

Approach/Results: In Phase I, KWJ will demonstrate sensitivity and stability needed to monitor fluctuations of N2 and Ar in synthetic air samples. The sensors will be characterized and tested for a suite of key gas sensor and analytical performance parameters under relevant environmental conditions for atmospheric measurements. The selectivity of the proposed sensor will be improved using KWJ's micro-fabricated designs being developed in collaboration with the Georgia Institute of Technology. An alternate technique for improving selectivity is also possible due to the ultra-fast nano-TCD sensor response, this will be investigated in Phase I and developed fully in Phase II.

Benefits/Innovation: KWJ has developed a process for fabricating sub-µm dimension TCDs, whose low thermal mass allows sub-millisecond measurement times, average power requirements of <10µW, and stability to allow billions of measurements without drift. KWJ has demonstrated quantitative measurement of a range of gases including N2 and O2, as well as CH4 and CO2, using the nano-TCD sensors.

This STTR Phase I proposal addresses development of a new, ultra-fast nano-sensor measurement technology that combines ultra-fast, micro-watt power nano-TCD sensors to enable high resolution, fast analysis of N2 and Ar, as well as future application to greenhouse gases CO2 and CH4 when improved sensitivity is realized. The nanosensor-based atmospheric analyzer will provide a new tool for qualitative, quantitative and spatial measurement and mapping of atmospheric gas fluctuations. This sensor is part of a broader effort to develop smaller, faster, lower power and more cost effective alternatives for a wide variety of applications including not only atmospheric measurements, but also area monitoring, medical, and personal safety monitoring.