593a On-Chip High Speed Gas Chromatograph (Gc) with Carbon Nanotube Sensors

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A micro-GC allows for small, handheld, low power equipments with on-chip devices for environmental sampling. In order to use a micro-GC as a fast chemical warfare agent scanner in highly industrious places like airports, there is a definite need for reduction in analysis times from the current state of the art. Current technology cannot scan (separate and detect) air samples in relatively short times (~ 4 seconds). High speed analysis GC requires 1) a continuous sampling part , 2) a preconcentration part, 3) micro-columns with high separation efficiency and resolution ability and 4) a detector with fast analysis time.

We use standard microfabrication techniques to create each of the components and test individual performance. Integration of the fabricated parts will not be demonstrated. A MEMS pump with a fluctuating polyimide membrane is fabricated to form the continuous sampling component of the GC. Preconcentration principle is demonstrated in a microfluidic processor with valves using metal-organic framework molecules as the adsorbing species. Micro-columns are fabricated in silicon using DRIE technique. High resolution columns are fabricated after studying effects of 1) various micro-channel bend geometries and 2) micro-channel configurations on chip. The detector side effort is focused on building a carbon nanotube based chemi-sensors. Carbon nanotubes are highly promising materials for sensing chemical species like thionyl chloride and dimethylmethylphosphonate, a simulant for chemical warfare agent sarin. Results of individual operational components are evaluated using an ordinary modified GC.