

Invited Talk: Merging MEMS and Nanotechnology to Take Micro Gas Chromatography Beyond Miniaturization

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Gas chromatography (GC) is the premier technique for separation and analysis of volatile compounds. The use of microelectromechanical systems (MEMS) technology for GC development is a promising approach to micro-instruments having lower cost, smaller size, lower power consumption, faster analysis, and greatly increased portability for in-field use applications in homeland security, food processing, petrochemicals, biomedicine, and environmental monitoring. In this talk, we will present the innovations and research accomplishments of VT MEMS Lab, a leading group in μ GC, from nano-structured material processing and synthesis to the development of the key components of GC including preconcentrator, microfluidic separation column, and gas detector demonstrating world-record efficiencies. We will present self-assembly techniques combined with high-aspect-ratio MEMS processing to achieve high adsorption efficiency for preconcentrators and high separation efficiencies for the columns. We will discuss the invention of new GC columns, semi-packed, multicapillary, and width-modulated, and demonstrate the marriage of MEMS and nanotechnology to improve stationary phase coating for GCs. In the final section of this talk, we will demonstrate how MEMS technology can be utilized to move from the current state of hybrid assembly to on-chip integration to realize GC sensors and to implement unprecedented GC architectures to achieve separation and identification of complex samples (>100) in a few seconds.