

First Micropump-Driven Micro Gas Chromatograph Separation

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The capability of gas chromatographic (GC) analyzers to separate and quantify the components of complex vapor mixtures renders them invaluable tools for chemical analysis. The WIMS μ GC development program exemplifies efforts by several groups around the world to realize a high-performance gas analyzer small enough to fit in a shirt pocket or be deployed unobtrusively in the environment as part of a wireless sensing network. Among several unique features of the WIMS μ GC that set it apart from contemporary alternatives is the incorporation of a MEMS vacuum pump to provide gas transport through the microsystem. Since prior efforts to develop low-power micropumps with a combination of high-volumetric gas flow and high-differential pressure generation have been unsuccessful, gas analyzers have had to rely on large off-chip pumps, which preclude full miniaturization and limit field applications. Last year, we reported on the development of such a micropump. This year, we have succeeded in integrating it with a microcolumn and a microsensor array to achieve the first micropump-driven, multi-vapor chromatographic analysis ever reported. The separation and detection of 11 volatile organic compounds with this all-MEMS microsystem was achieved in less than 80 seconds, while consuming just 15mW of power. With temperature programming this analysis can be completed in 24 seconds with only a slight loss in resolution. ■

