Reliable and Efficient Separation Columns With Thermally Stable Stationary Phases

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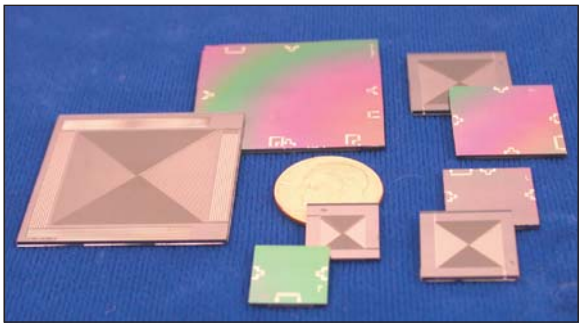
Several of the most critical factors affecting the performance of the WIMS μGC relate to the DRIE-Si/glass channels used as gas chromatographic (GC) separation microcolumns, specifically, the consistency and uniformity of stationary phase deposition, the deactivation of surface-adsorption sites on the microcolumn walls, and the stability of the stationary phase following repeated thermal cycling. This year, we demonstrated that films of polydimethylsiloxane (PDMS) can be reliably and reproducibly deposited in microcolumns 0.5 to 3m long and cross-linked *in situ* to provide unprecedented separation efficiency and stable performance even up to 200°C in air.



In addition, use of hexamethyldisilazane (HMDS) as a surface deactivation agent was shown to be highly effective. The values of chromatographic efficiency achieved, up to 4,900 plates/meter, are the highest values ever reported. The variation in efficiency among multiple-coated columns is <5% (rsd, n = 10), which is remarkably low and demonstrates that the coating process is robust. Pre-treatment with HMDS dramatically reduced peak broadening associated with wall adsorption by polar analytes. The PDMS stationary phase was stable to very high temperatures in air, which bodes well for using such microcolumns to separate compounds with very low vapor pressures (e.g., explosives, pesticides, etc.) in field applications using ambient air as the carrier gas. ■