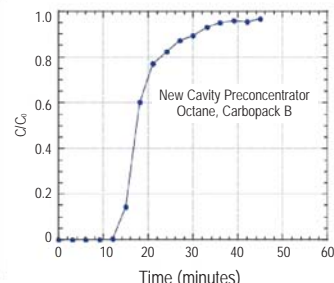
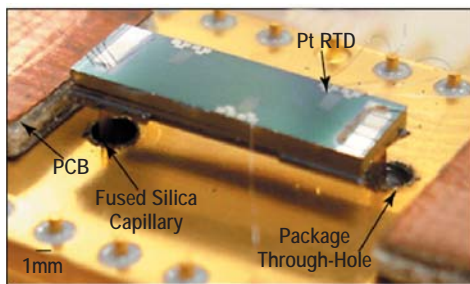


A Microfabricated Preconcentrator for Gas Chromatography

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An important milestone was reached recently in the realization of a microfabricated preconcentrator for gas chromatography. The 44mm^3 preconcentrator performs exhaustive sample extraction and injection in a single unit. Using $180\text{--}212\mu\text{m}$ -diameter graphitized carbon black granules and carbon molecular sieves residing in $450\mu\text{m}$ -deep micromachined silicon cavities, the preconcentrator adsorbs volatile organic compounds (VOCs) at part-per-billion concentrations as an air carrier passes through the cavities. Injection can then be performed by rapidly heating the device to 300°C with 1.8 watts to desorb the VOCs into the separation column at part-per-million concentrations. This is the first granular adsorbent preconcentrator integrated at the wafer level and the first preconcentrator with proven exhaustive extraction and injection performance. Decane at $1\mu\text{g}/\text{L}$ is preconcentrated to $346\mu\text{g}/\text{L}$; 1.13L of octane at $42.89\mu\text{g}/\text{L}$ and $25\text{mL}/\text{min}$ can be extracted before breakthrough. With 3:1 split-flow, an $8\text{mL}/\text{min}$ carrier, and 30s stop-flow heating to 300°C , 100ms injections have been demonstrated. ■



A quantitatively loaded microscale granular carbon preconcentrator mounted in a hybrid package with a 1mm air gap. At right, a breakthrough curve from the preconcentrator showing exhaustive extraction for an input of octane at $25\text{mL}/\text{min}$ with room-temperature adsorption on Carbopack B.