

## **Micro Ion Trap Mass Spectrometry**

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There has been growing interest in miniaturization of chemical measurement systems over the past decade. Earlier work focused upon chemical sensing strategies that utilize molecular recognition phenomena to provide selectivity. Such approaches have had limited success when dealing with complex or variable chemical matrices. An alternative miniaturization strategy is the miniaturization of conventional chemical measurement instrumentation. Such a strategy was first reported 25 years ago in the form of a micromachined gas chromatograph. More recently microfabricated fluidic systems have been demonstrated and commercialized that perform liquid based chemical and biochemical assays. We, and others, have extended this notion of miniaturized chemical instrumentation to mass spectrometry.

Specifically, we have been exploring the miniaturization of ion trap mass spectrometry with cylindrical ion traps as small as 0.25 mm radius. These cylindrical ion-trapping electrodes have been fabricated using conventional machining procedures. As predicted by the equations of motion for ions in quadrupole ion traps, smaller traps can be operated at higher frequency and lower voltage than conventional laboratory mass spectrometers. Mass resolution commensurate with conventional ion traps can be attained under these conditions. Tandem mass spectrometry has also been demonstrated in miniaturized traps, retaining the ion traps advantage for chemical structure elucidation. Moreover, we have demonstrated the ability to operate small traps at higher pressures (100 mtorr) as predicted by theory. High-pressure operation may provide significant advantages for reduction of system size, weight, and sensitivity. Progress in developing a battery-powered hand-held prototype based on this technology will be discussed. This prototype device has a weight of 10 kg, and consumes 75W of electrical power.

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