



## It's a Small World

**The Column spoke to Job Elders of C2V about developments in micro gas chromatography.**

### Why did you decide to develop a micro gas chromatograph?

There is an ongoing demand for faster analysis, automation, smaller carbon footprints and easier to use and maintain (micro) gas chromatographs in both laboratory and industrial process control applications. Larger GCs often contain expensive components, such as an injector, a detector and a long column, or smaller components that are interconnected with capillaries. We developed a microelectric mechanical system (MEMS) chips-based platform — the *C2V-200 micro GC* — for fast analysis in a smaller package with reduced components and manufacturing costs. The column cartridges can be easily changed, which reduces maintenance to exchanging parts instead of repairing them. The instrument is designed for gas analysis and allows fast 'almost' real-time on-line measurements. In practice, this means that analysis times can be reduced to less than 30 seconds.

### What are the main features of this instrument?

The *C2V-200* micro gas chromatograph has temperature programming up to 180 °C and is a fully integrated micro gas chromatograph with the core technology contained in a credit card-sized cartridge, weighing less than 50 g. This cartridge contains the separation column with temperature programming, a thermal conductivity detector, the sample loop and an injector. The accurate micro-injection of this fast GC meets applications such as the BTU caloric value determination of natural gas for fiscal metering or custody transfer, which requires a repeatability better than 0.01%. The speed is demonstrated in a C<sub>3</sub>–C<sub>10</sub> natural gas analysis within 30 s with ppm sensitivity (Figure 1).

### What is unique about this instrument?

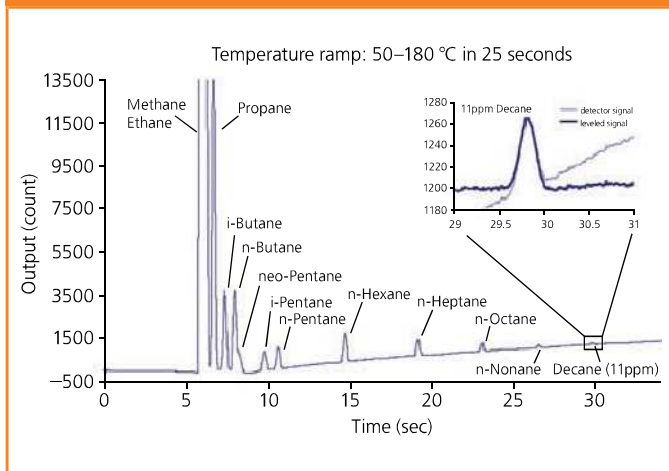
Besides the speed and size, the *C2V-200* micro gas chromatograph contains a credit card-sized cartridge containing the analysis technology. The cartridge is manufactured based on production processes similar to those used in the integrated circuit industry. We can customize cartridges and automate the analysis for individual applications. This can be done by selecting the right hardware (column) and programming of the right method and parameter settings in the cartridge. Each cartridge contains a memory chip for this purpose. The pre-programmed cartridge that can be changed within a minute eliminates local repair and optimization and, therefore, becomes cost-effective and significantly reduces the training requirements of the users.

Another unique feature is the modularity of the multichannel GC. Several GC modules — each with their injector, column and detector oven cartridge on a foot — can be (dis)connected and a multichannel GC with common gas lines can be attached or separate individual GCs can be configured. Options that can be changed include a carrier gas change block, a stream selector or a vacuum sample pump. This allows flexible set-up changes without new investments.

### What applications is this instrument aimed at?

The instrument can be used for (headspace) non-condensing gas analysis, in the laboratory and for on-line processes. Fast analysis of a wide range of hydrocarbons and (permanent) gases, natural gas, biogas, air, non-condensing solvents, alcohols and flavours from 1 ppm to 100% concentrations are possible. Typical applications are natural gas analysis, BTU value for fiscal metering

**Figure 1:** Example of hydrocarbon gas analysis up to C<sub>10</sub> within 30 seconds demonstrating temperature programming sub-ppm sensitivity for decane. (C<sub>10</sub>)



or custody transfer, mudlogging, environmental and many on-line process monitoring applications where fast feedback on a gas composition is required. This can be the case for reactors, turbines, reformers, mixers and production plants.

For process analytical on-line applications, the C2V-200 *micro* GC is made compatible to the NeSSI platform — a New Standard Sensor Sampling Initiative — that has served as a forum for the adoption and improvement of an industrial standard that specifies the use of miniature and modular *Lego*-like flow components (see also the SP79.01 standard).

**What column technology can you apply?**

We have chosen to apply proven column technology to be able to quickly develop applications based on users' experience. This means that we can integrate any available column that physically fits in our cartridge. In practice these are narrow bore capillary columns (up to 0.25 mm i.d.) as well as (micromachined) packed columns.

Currently, we offer standard column types: non-polar polydimethylsiloxane (PDMS), PLOT type U, PLOT type Q and molecular sieve. If applications require other types of columns and they fit in our package, we can very

quickly adopt these columns. We are also interested in developing silicon-based columns because — from a technology perspective — this would enhance the manufacturing integration level and allow even faster thermal management.

We will continue to add new developments to this micro GC platform, including more extensive temperature programming capabilities and stretching sensitivities into the ppb regime.

**Job Elders** is co-founder and CEO of C2V. He co-founded TMP in the mid-nineties and served as TMP's managing director until its successful acquisition in September 2000 when he became general manager for the Dutch operations. Since Alcatel's subsequent acquisition of the operations in 2001, Dr Elders served as vice president and general manager of NASDAQ listed Alcatel Optronics Netherlands. Elders is the author of more than 70 technical papers, business papers and patents and he is a board member of Point-One ([www.point-one.nl](http://www.point-one.nl)). He received his Masters degree in Chemistry and a PhD in Physical Chemistry from the University of Amsterdam.



Job Elders