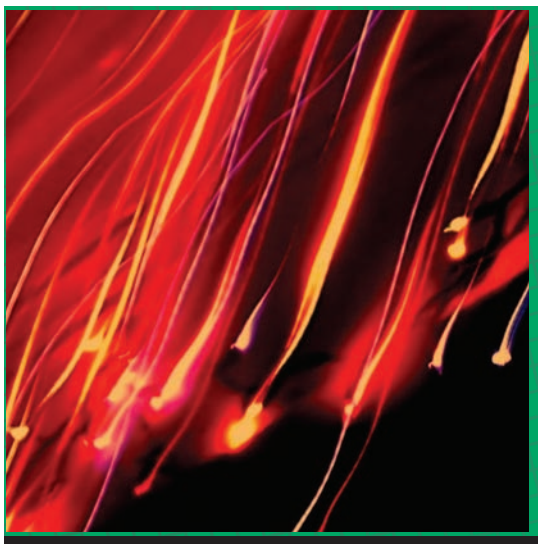

Low Energy, Low Temperature Liquid Source Evaporation Gas And Liquid Ratio Control to Create Precise Vapour/ Humidity Atmosphere and Process Conditions

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Many industries require a liquid source to be converted into a homogenous vapour. Traditional methods have involved either bubbling a carrier gas through the liquid source whilst precisely controlling the temperature and pressure, or directly introducing the liquid source onto a hot surface or plate. The former is extremely reliable, well-proven and offers high repeatability/reproducibility once the controlled process parameters have reached steady state. It is, however, less suited to applications where step changes in concentration are required, where fast switching on-off is required or where multiple liquid sources need to be introduced through one, single evaporation system. Furthermore, this system requires a large volume of potentially hazardous liquid to be housed in a pressurized (glass) container close to the application – often not ideal in highly populated laboratories. The latter has benefits as a highly simplified system however the temperature required for evaporation is much higher, the energy consumption is extremely high and variable control of flow rate/concentration can only be achieved on long cycle times.

Bronkhorst has overcome these short-falls with a pre-engineered, low temperature, low energy consumption evaporation system that is ideal for variable flow rates, variable concentration, fast switching and multiple liquid sources. Bronkhorsts' New Vapour Delivery Modules (VDM) are leading the way in vapour generation and control as a pre-assembled easy to use, plug and play, format. Simply connect the Gas and Liquid and Power to the unit and all is ready. The flow rates and heater temperature can then be set by using the easy to use OLED local display and control screen and the unit is working. An extremely useful benefit is that the VDM also has pre-existing electrical sockets for both a Trace Heated Line and a PT 100 thermocouple thereby simplifying the engineering, and control, of a uniform temperature after the outlet. The addition of trace heating can be useful when components of the vapour are prone to drop out of the vapour phase or where extremely low flow rates or pressures are involved.

At the very heart of the VDM is the tried and tested Controlled Evaporator Mixer (CEM) System supplied by Bronkhorst for many years. However, recent innovations in both liquid and gas control have further extended the capability and areas of use and these improvements have been incorporated into the VDM design.

What is available for Vapour Generation:

Traditionally, a liquid vapour within a carrier gas has been generated by using a Bubbler System although more recently Vapour Source Controllers have been used. Commonly, however, neither of these solutions can handle sufficient quantities of liquid with a low vapour pressure such that their performance rapidly deteriorates. Moreover, they cannot instantaneously provide vapour of a mixture of liquids with different vapour pressures.

Bronkhorst High-Tech has therefore developed a unique patented system to realise perfect ratio control of a gas and a liquid with controlled atomization and stable temperature control. Mass Flow Control of Vapour with the Vapour Delivery Module (VDM) can be applied to atmospheric, pressurised and vacuum processes.

Typical Applications:

Applications are extremely varied, spanning virtually every industry sector, with our customers regularly finding even more new and innovative ways to benefit from the technology. Common applications can be found in the Semiconductor Industry (ALD, APCVD, (MO)CVD, PECVD), the Analytical Industry (GC, MS), the Fuel Cell Industry (humidity control) Pharmaceutical and Biotech Industries, Solar Cell and Glass Production, Surface Treatment (surface coating of tools) and the Medical Industry (anaesthetic delivery and humidified synthetic breath generation) to name just a few. This list goes on…..

With an accurately controlled ratio of gases (where more than one gas type is used) and a precisely controlled injection rate of a liquid source it is possible to calibrate other scientific instruments such as Gas Chromatographs, Mass Spectrometers and other gas sensors.

Technical Description

At room temperature the liquid is drawn from a container (with an inert gas blanket or membrane) and measured by a liquid flow meter. The required flow rate is controlled to the setpoint value by a control valve forming an integral part of the patented liquid flow and carrier gas mixing valve. The gas is applied to the mixing chamber from a Gas Controller accurately supplying the required gas to be mixed with the liquid. This mixture is then directed to the heating module of the system where the mixed gas and liquid are vaporized with a controlled heating range from room temperature to 200 Deg C. A complete system also incorporates a readout/control unit, including power supply, for operation of the CEM-system devices.

Features

- Compact design that is safety tested and ready to use.
- Clear, local 1.8" display for control with Alarm and Counter functions.
- Fast response & high reproducibility.
- Highly accurate controlled gas/liquid mixture
- Very stable vapour flow
- Lower working temperature than conventional systems
- Low power consumption
- Optional interface / control by PC/PLC (RS232/flowbus)

Liquids that are often used: (a selection of some references)

• ETOH • SnCl4 • TiCl4 • HMDSO • TCA • TMB • HMDSn • TEOS • Water • SiHCl3 • TIBA • Zn(C2H5)2 • SiH3Cl • CupraSelect™ • Organic compounds (such as Acetone, Alcohol, Butanol, Ethanol, Hexane, Methanol, etc.)

In summary, the Bronkhorst Vapour Delivery Module is standardised design solution whereby the components of the traditional CEM system have been engineered into a tailor-made housing. The design can, however, be tailor-made to meet any particular configuration that a customer may wish. The "plug-and-play" module could be a stand-alone process or laboratory instrument or could be designed to be close-coupled to other equipment and analytical instruments to form a more complex solution. Above all, the modules have been designed to be extremely easy to use, pre-tested, safe and ready to use "out of the box".

All the above instruments are available in varying capacities depending on the total output required.