Business Unit Waste Gas Treatment

Areas of Application: Semiconductors, Photovoltaics, LED Industry, TFT/Flat Panel Industry, Nanotechnology, MEMS

Waste gas treatment basics

Many industrial and research production procedures use process gases and generate waste gases. These waste gases are toxic and/or highly flammable and very often pose a significant risk to production facilities and the environment. The semiconductor industry, for instance, uses perfluorocarbons, whose global warming potential is extremely high. Combining and transporting different gases into a fab's central waste gas system might produce highly flammable and highly explosive gaseous mixtures, which in the past has occasionally caused the total loss of entire production facilities. Particles contained within gases may also cause exhaust blockages. To eliminate these risks, process waste gases need to be treated at the "Point of Use" (POU) where harmful exhausts are abated immediately. In the early 1990's no appropriate and comprehensive technical solution had yet been available.

Since 1992 the POU equipment, developed and manufactured by DAS Environmental Expert GmbH, has mastered the task. No matter if silane, phosphine or CFC, DAS equipment can, depending on customer requirements, treat waste gases from practically all production steps in the chip industry, safely and in an environmentally compatible way. DAS equipment can be used for virtually all modern coating and etching equipment. Their efficiency reaches more than 99 % with most gases and thus exceeds the standards set forth by the TA-Luft (according to German Clean Air Regulations).

DAS technology is based on a flexible, integrated product concept, which combines process gas supply, process equipment and process waste gas abatement in one single system. The smallest equipment fits into a closet of less than a 1 square meter footprint. DAS technology is fully automated and sensor-controlled and meets the highest safety standards. In the field of waste gas treatment, DAS currently holds 9 registered patent families.

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Burn/Wet Systems (ESCAPE, STYRAX, UPTIMUM, TILIA)

DAS burn/ wet systems stand for the abatement of dangerous process waste gases and their fission products through controlled combustion to harmless end products.
Therefore waste gases are induced directly into the burner flame and followed by a wet scrubbing procedure. Also very stable pollutants can be abated in the hot flame with up to 1400 °C. The systems can be used with different fuel gases, such as hydrogen, natural gas or propane. Depending on the required temperature range oxygen or compressed dry air are used as oxidant.

Interfaces make it possible to remotely control the ESCAPE systems directly from the production facility and accurately adjusting them to current pollutant emissions. During the scrubbing process, water, lye or other fluids absorb the gaseous or solid combustion products or assimilate suspensions and cool down the gases.

The key to the ESCAPE technology's efficiency is the combination of the two procedures burning & scrubbing in the smallest possible space – two basic technologies that, each on their own, reliably and efficiently abate specific process waste gases, but usually exclude each other in such close proximity. Combining the two principles enables the abatement of process waste gases at very high efficiency rates and meets high security standards while offering significant economic advantages.

ESCAPE series

ESCAPE stands for Environmentally Safe Cleaning And Protection Equipment. These are burn/wet systems with the DAS basic technology, which is successful for more than 20 years. More than 3,000 systems have already been sold worldwide. They can be used for many processes of the semiconductor and photovoltaics industries and meet the highest deposition rates.

All ESCAPE systems can be installed directly next to each other with access to maintenance areas on the front and the back side. The system's core, the burner unit and reactor, can easily be removed without tools in a few steps, as soon as the system is turned off.

Based on the ESCAPE series and on customer demand, DAS Environmental Expert has developed several adaptations that are now available as separate series:

ESCAPE *INLINE* – the basic configuration with the described technology including burners, scrubbers and washing liquids adapted to the specific process gases.

ESCAPE *DUO* – features two reactors operating simultaneously, which can function as each other's back-up during maintenance or in the event of an error.

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UPTIMUM and UPTIMUM *PLUS*

The UPTIMUM series was developed specifically for the treatment of large amounts of waste gases by burning and scrubbing. Comparable to the basic concept of the ESCAPE series, UPTIMUM is specifically designed to the needs of the photovoltaic industry (silicon thin film). Due to the possibility to handle high process gas flows it is also applicable to most difficult processes of microelectronics. Especially for processes where large amounts of particles are formed, the reactor design is ideal and cost effective with low maintenance.

The burner configuration as well as the selection of the washing liquid are similarly configured flexibly just like the ESCAPE series and precisely tailored to the customer requirements. The UPTIMUM series is a successful part of the DAS product range since 2007.

STYRAX series

STYRAX represents the fusion of treating high volume flow rates with the configurability of the ESCAPE series. STYRAX is a burn/wet system based on the technology of UPTIMUM. It is specifically designed to the requirements of CVD applications (increased capacity for CVD gases in comparison to the ESCAPE series).

Through the optimized design STYRAX systems achieve destruction and removal rates more than 99 % and long maintenance intervals. Due to its high capacity and versatile configurability there are diverse possibilities for semiconductor and photovoltaic processes.

STYRAX *INLINE* – basic configuration, with various burners, scrubbers and washing liquids, adjusted to the occurring process gases.

STYRAX *TWICE* – double system (with higher capacity) with two independent reactors, a common media supply and a common control unit.

STYRAX *DUO* – features two reactors operating simultaneously, which can function as each other's back-up during maintenance or in the event of an error. The uptime exceeds 99 % which results in a very low downtime for the connected process equipment.

STYRAX *DUO EPI* - system based on STYRAX *DUO* with optimized components for epitaxy processes, where strong corrosive waste gases with high hydrogen flows are typical. The system design includes highly resistant materials, such as special seals, and an optimized heat exchanger. The systems are equipped with special safety features and sensors.

TILIA series

TILIA is a burn/ wet system based on the technology of UPTIMUM and STYRAX DUO for challenging CVD and Etch applications. The integrated back-up function guarantees a high uptime for connected process tools.

Burner System

LARCH

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LARCH is a POU waste gas abatement system without washing liquid especially designed for manufacturing processes of the LED industry (MOCVD processes). It is capable of treating large flows of hydrogen and ammonia as well as small flows of metal organics and dopants. The tool is suitable for common LED processes such as white LEDs.

Through the usage without scrubbing liquid, there are no disposal costs while the investment and operating costs are low.

Scrubber Systems (AQUABATE, SALIX)

AQUABATE Series

AQUABATE stands for the treatment of process waste gases by selective wet scrubbing. The systems are designed only as a scrubber, without burner unit. The harmful gases are dissolved in one or more stages of wet scrubbing. Depending on the process the systems can wash the waste gases with acid, lye or water. They are used to abate water soluble waste gases. AQUABATE Series is part of the DAS product range since 2004.

AQUABATE *EPI* – specially designed scrubber for the handling of hydrogen, abatement of epitaxy processes and similar processes. The system is resistant to acid and has a continuously evacuated cabinet. After the wet scrubbing the hydrogen-containing gas is diluted to prevent the occurance of explosive mixtures.

AQUABATE *FLEX* – modular wet scrubber with high capacity which can be flexibly adapted to different customer requirements. Both single-stage as well as two-stage scrubbing processes can thus be realized with the scrubbing liquids acid, lye or water.

AQUABATE *COMBIBURN* – combination of **AQUABATE *EPI*** and **ESCAPE *PLUS*** for abatement of epitaxy processes with high hydrogen amounts. Soluble substances are treated in the wet scrubber. Afterwards the hydrogen is removed by combustion.

SALIX and SALIX *MINI*

SALIX is the latest point-of-use wet scrubber from DAS especially designed for the treatment of harmful gases from wet bench applications. The system does not use dilution air. The expensive conditioned clean room air is preserved. The scrubbers can work in two independent scrubber columns with different washing liquids (acid, lye or water).
SALIX *MINI* is the derivative ot the SALIX and requires a lower footprint while offering comparable performance.

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Electrostatic dust collector

EDC and EDC *PLUS*

EDC stands for the treatment of process waste gases with a high content of particles and aerosols through electrostatic precipitation. Particle- or aerosol-containing process waste gases are typical in solar cell manufacturing where they can block exhaust systems. These micro- and nanosized dust particles can be removed inadequately by conventional wet scrubbing. In the EDC system the dust particles are ionized by high voltage electrodes and washed in a water flow. Here the groups of columns are rinsed with water and continuously cleaned. Due to the high deposition rate of above 99 %, EDC will not only comply with the strict limits of the TA Luft, but also prevent blocking of the process lines.

EDC *PLUS* was developed for the treatment of particularly larger process waste gas volumes. A still higher deposition efficiency and process availability are guaranteed with four groups of columns.
In combination with burn/wet systems like STYRAX, the EDC/ EDC *PLUS* is connected downstream and can be easily coupled to the process. Thus, the dust collection is only active if dusts forming corrosive gases occur. The operating costs are sustainably optimized.

Service

DAS offers a 24/7 service for system maintenance at customers' sites. Our service teams consist of DAS employees either working at DAS branches or directly at the clients' fab depending on the size of the installed basis. That is how service work is guaranteed at all times. Sometimes also employees of a partner company or the customer are being trained by DAS to fulfill service activities. Appropriate software tools and service network connections do allow a remote supervision of DAS systems – either at the production facility or across continents and oceans at the DAS headquarters in Dresden.

Our Service Tasks:

1. Basic support comes with all DAS waste gas treatment systems to ensure smooth operation.

2. A mix of customized support will be developed to enhance process performance aiming for best uptime results.

3. Interactive process and data analysis are used to achieve continuous improvement, long-term performance stability and progress.

4. All DAS services are transferred to a global scale for all customer sites and tools pushing equal service quality standards and cost reduction globally.

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Business Unit Waste Gas Abatement/ Wastewater Treatment

Area of Application: Solar Industry

Generating solar energy is considered a green technology, even though the production of solar cells predominantly uses process stages that have been common practice in the semiconductor industry for many years. As in the semiconductor industry the production of solar cells employs dangerous and environmentally harmful substances, which require abatement according to legal provisions.
The production of photovoltaic cells therefore is subject to strict requirements for abatement processes. Solutions need to be easy and cost-effective. The contaminated waste waters and waste gases should, under no circumstances, endanger the health and safety of humans, lower performance, or otherwise negatively affect the availability of production facilities. The safety of the production line must be guaranteed at every step and in every operating situation.

Requirements for Abatement Solutions in the Photovoltaic Industry

The demand for so-called “grid-parity” puts the photovoltaic industry under high cost pressures. The producers of solar cells therefore have expressed a growing demand for standardized processes and facilities. Integrated abatement solutions for the photovoltaic industry are therefore characterized by equally high proficiency in treatment of contaminated waste gases as well as waste waters. At the same time, all components need to work in a harmonized and compatible way. The abatement technology must guarantee the continued compliance with all legally binding emission regulations like TA-Luft (German Clean Air Regulations). And moreover, they should be adaptable to future legal regulations without any additional investment.

Competency and Know-how

DAS Environmental Expert GmbH specializes in waste gas abatement and wastewater treatment solutions that meet the highest safety and quality standards. Abatement technology by the Dresden-based company has been successfully employed in the global semiconductor industry for more than 25 years.

As a specialist for “point of use” (POU) abatement technology, DAS not only possesses extensive know-how for abatement of contaminated waste gases, but also the technological competence to deliver answers on the topics of operating safety and equipment integration specifically for the photovoltaic industry. Our knowledge is the basis to develop and provide abatement solutions that individually meet each specific demand. DAS Environmental Expert GmbH, moreover, has many years of experience in the treatment of contaminated industrial wastewaters – specifically particle-containing wastewaters as they occur in the solar industry.

Based on this expertise DAS Environmental Expert develops economically sensible abatement solutions that are characterized by high functionality and high operating safety. To achieve this goal, DAS does not rely on adapting equipment from other fields of use, but develops specific solutions tailored to each customer’s application.

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DAS Environmental Expert GmbH products offer integrated solutions for treating waste gases, wastewaters and fine particles. This combination enables the efficient treatment of all pollutants in wastewaters and waste gases accrued by the solar industry. Depending on your DAS product the reusage of water is a possibility to significantly lower the operating costs.

Highest reliability while keeping operating costs low – this is the strength of abatement solutions made in Dresden. With its technology, DAS Environmental Expert ensures that photovoltaics will maintain its growth opportunity as a green and environmentally friendly technology and as a source of renewable energy.

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