Taking the better solution several steps further

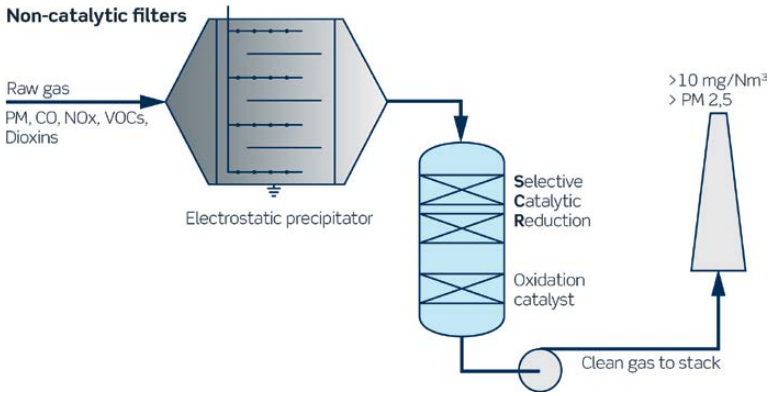
Catalytic ceramic filters have changed the standard for efficiency in air pollution control with one-step removal of dust and NO_x and given the possibility of dioxin destruction. Now, the latest technology from Topsoe resolves multiple industry challenges in a next generation line of filters. Antonio Mayo Martinez reported in *Glass Worldwide*, preferred journal of AIGMF and GlassTrend.

Air pollutant emissions are regulated with tighter limits globally for both new and existing plants – for industries in general and in the glass business in particular. The importance of emission control has driven the development of technologies that individually remove the different pollutants, while leaving some other technologies obsolete.

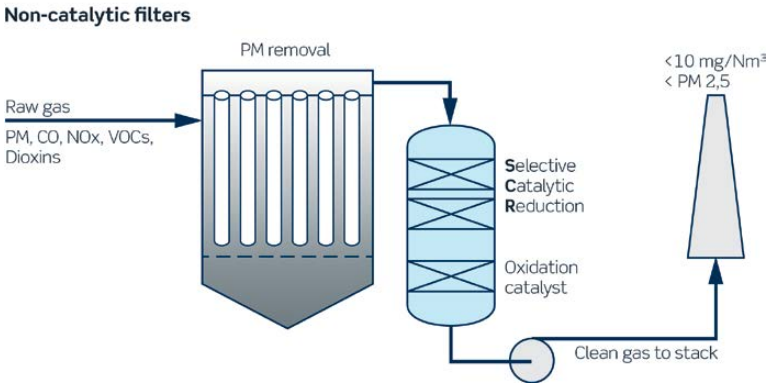
When it comes to air pollution control systems, plant operators can choose between a wide variety of technologies that remove each particular component in a separate step with an associated capital (CAPEX) and operational cost (OPEX). For example, ceramic filters are widely used in the glass industry with dust removal efficiencies of +99%, while SCR (selective catalytic reduction) is typically used for the removal of NOx and dioxins. Also, different oxidation technologies are employed when removing CO (carbon monoxide) and VOCs (volatile organic compounds).

During the last decade, catalytic ceramic filters have successfully changed the emission control game by offering the combined removal of dust, NOx and dioxins. The use of catalytic ceramic filters helps decrease CAPEX and OPEX, as well as the footprint in the plant compared to multi-step solutions. The technology also helps to minimise shutdowns, as replacement of the filters can be performed during operation.

However, most catalytic ceramic filters based on vanadium oxide, while very active for $DeNO_x$ purposes, cannot achieve the removal of CO and they have a low selectivity of CO_2 when oxidising VOCs, which can actually result in forming undesirable CO. With its latest range of catalytic ceramic filters, Haldor Topsoe A/S aims to resolve this and several other known issues within dust and emission control.



Traditional electrostatic precipitator (ESP) with tail end removal of NO_x and VOC (image: Haldor Topsoe A/S).



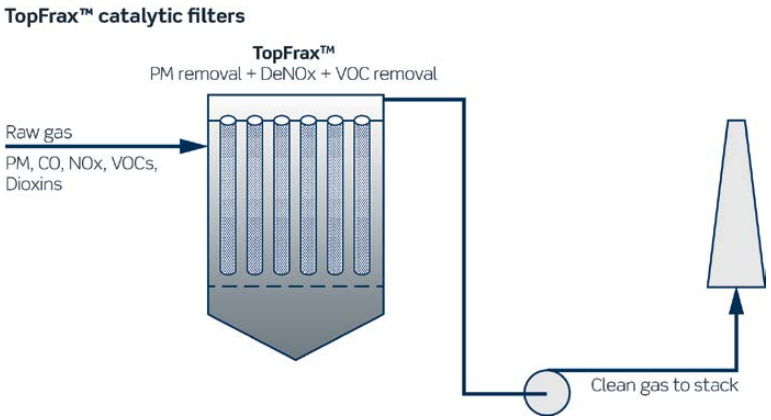
Two-stage system with initial dust removal (non-catalytic filtration), followed by tail end removal of VOC and NO_x (image: Haldor Topsoe A/S).

TECHNOLOGY IMPROVEMENTS

As discussed in the July/August 2017 issue of *Glass Worldwide,* Denmark's Topsoe and specialty fibre manufacturer, US-based Unifrax have combined their expertise to bring to the market a second generation of proprietary catalytic ceramic filters. These are the only filters in the market embedded with Topsoe's highly advanced catalytic slurry.

With multiple improvements compared to competitive technologies, the recently introduced TopFrax filters address several known industry challenges such as CO and VOC removal, avoiding contamination of the active catalyst and improving mechanical strength and operational safety.

To accommodate increasing demands for CO and VOC removal, Topsoe has made its filters available in two different versions: >



One-stage system with TopFrax catalytic filters removing dust, NO_x, CO, NH_3 and VOC simultaneously (image: Haldor Topsoe A/S).

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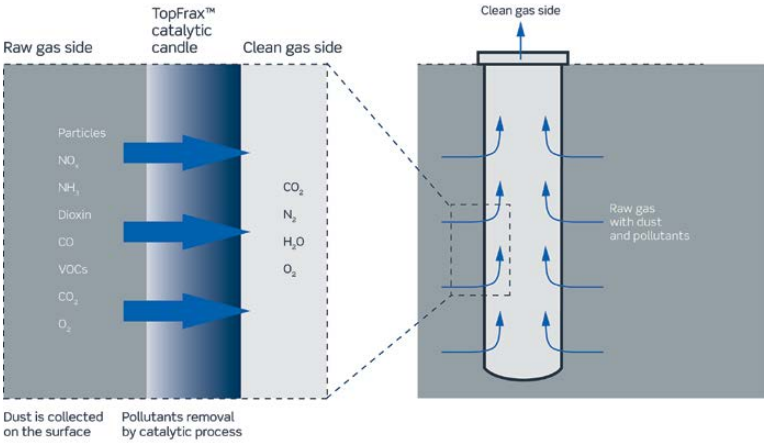
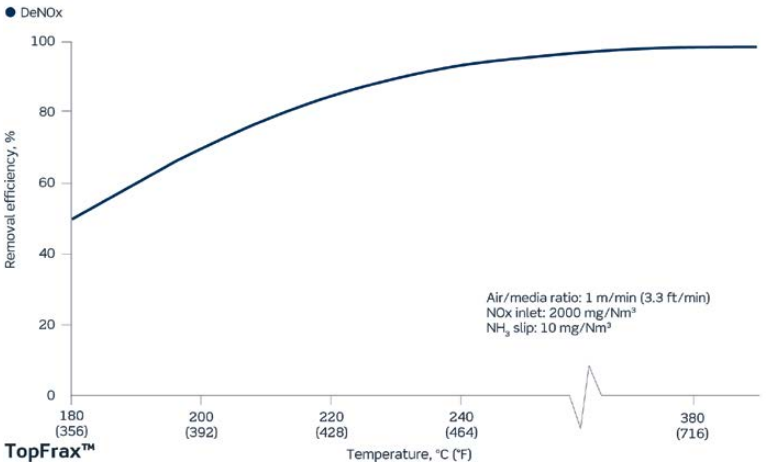
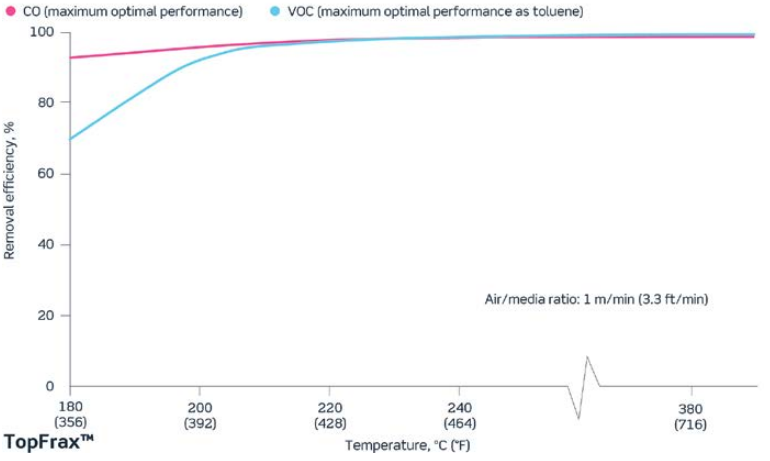


More plants are requiring a stricter emission removal system for CO and VOCs, while reducing NO_x and separating the dust. Now it is possible to clean the main regulated species from practically all industrial flue gases (image: Haldor Topsoe A/S).



TopFrax technologies are able to remove dust down to levels below 1mg/Nm^3, ensuring a filtration efficiency of 99.95% removal of fine particles PM 5.0 (5 µm) and 99.9% of PM 1.0 (1 µm) (image: Haldor Topsoe A/S).



The catalytic sites on TopFrax candles oxidise CO and volatile organic compounds into harmless CO_2 and H_2O. In addition, TopFrax OXI ensures optimal combustion of VOCs, with no additional emission of CO (image: Haldor Topsoe A/S).

Topsoe's Antonio Mayo Martinez (left) in conversation at the TopFrax installation at Lauscha glassworks, Germany (image: Haldor Topsoe A/S).

TopFrax filter cut, showing the effects of the patent-pending shell impregnation method (image: Haldor Topsoe A/S).

- TopFrax DNX for the removal of dust in combination with NOx and/or dioxins.
- TopFrax OXI for the removal of dust in combination with NO_x, dioxins, CO and VOCs.

TopFrax ensures compliance with limits on dioxins and furans by converting them into harmless compounds and reducing their concentrations to below 0.1ng/ Nm^3, TEQ.

PATENT-PENDING PRODUCTION METHOD

TopFrax filters are impregnated in a process that enables Topsoe to load the catalyst in a well-defined and adjustable fraction of the filter wall. This patent-pending shell impregnation method permits the catalyst load to be designed to match the customer's required performance, while also limiting undesirable side-reactions, such as oxidation of SO_2.

Furthermore, shell impregnation means that the catalytic fluid remains on the inside of the filter, consequently avoiding the deactivation of the active sites from chemical and/or physical poisons. These deactivators will simply not reach the catalyst, as they will in traditional catalytic ceramic filters.

Finally, Topsoe's impregnation method also helps promote safer handling of filters, since operators experience much less contact with the chemical components during installation.

MECHANICAL STRENGTH INCREASES LIFETIME

One challenge that some operators of traditional catalytic ceramic filters mention is breakage during installation and operation. Topsoe and Unifrax have tackled this problem by manufacturing TopFrax filters in a conical shape, with a strengthened after-treatment in the flange and the bottom of the filters, ensuring a more robust mechanical stability and decreasing the possibility of breakage during installation and operation. The combination of these improvements results in a stronger filter, with a higher mechanical lifetime.

The constant development of TopFrax is only possible thanks to the company's continuous and close contact with customers to understand their needs and requirements, combined with intensive R&D efforts for continuous improvement of the technology. It is the in-depth understanding of the combination and interaction of the different air pollutants and their effect on the catalytic filtration technologies that makes the true difference, when ensuring dust and toxin removal to the required levels.

During the 'Emissions from glass furnaces' GlassTrend seminar last April, Antonio Mayo Martinez presented the paper 'Improved solutions for hot gas filtration, Insights on removing dust, NO_x, VOC, CO and dioxin in one process with catalytic ceramic filters'. ■

TopFrax is a registered trademark of Haldor Topsoe A/S.

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