Recycling of Vehicle Catalytic Converters

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The vehicle catalytic converter, is used for exhaust gas aftertreatment in vehicles with internal combustion engines. The catalytic converter can drastically reduce pollutant emissions in the exhaust gas. In most cases, the entire exhaust gas aftertreatment system is referred to as a vehicle catalytic converter.

The task of the vehicle catalytic converter is the chemical conversion of the combustion pollutants hydrocarbons (CmHn), carbon monoxide (CO) and nitrogen oxides (NOx) into the non-toxic substances carbon dioxide (CO_2), water (H_2O) and nitrogen (N_2) by oxidation and respectively by reduction. Depending on the operating point of the engine and under optimal operating conditions of the catalytic converter, conversion rates close to 100% can be achieved.

The automotive catalytic converter usually consists of several components. The carrier is a temperature-stable ceramic honeycomb body, usually cordierite, which has a large number of thin-walled channels. The so-called washcoat is located on the carrier. It consists of porous aluminium oxide (Al_2O_3) and serves to increase the surface area. Due to the high roughness, a large surface area of up to several hundred square meters per gram is realised. The catalytically active substances are embedded in the washcoat. These vary depending on the type of catalyst. In modern three-way catalysts, for example, these are the precious metals platinum, rhodium or palladium, or a combination of these [1].

In the laboratory experiment, the ceramic honeycomb body is to be crushed to powder in order to subsequently examine this for the catalytically active precious metals.

The first experiment

In the first experiment, the honeycomb body was pre-comminuted in the Universal Cutting Mill PULVERISETTE 19 LARGE. The instrument was equipped with a disk milling cutting rotor with indexable inserts and fixed knives made of hardmetal tungsten carbide, a sieve cassette square perforation 4 mm, as well as a high-performance Cyclone separator made of stainless steel. The grinding time for the sample was about one minute at a speed setting of 1,500 rpm.

Figure 1. Ceramic parts catalyst with fleece sides.

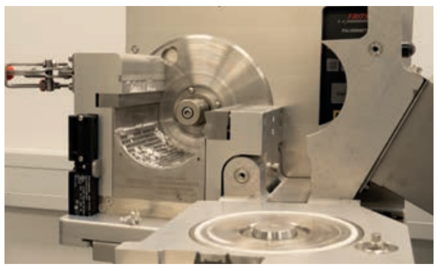

Figure 2. Grinding chamber PULVERISETTE 19 LARGE after comminution.

Figure 3. Cyclone separator with sample glass with ground sample.

Second test

In the second test, a part of the pre-comminuted sample from the PULVERISETTE 19 LARGE, was further processed in the PULVERISETTE 14 premium line. Two hundred milliliters of the sample were comminuted within 38 seconds to a final fineness < 500 µm. The PULVERISETTE 14 premium line was equipped with the cutting rotor, as well as additionally connected to the small volume Cyclone separator, which was operated passively.

Figure 4. PULVERISETTE 14 premium line and the small volume Cyclone separator.

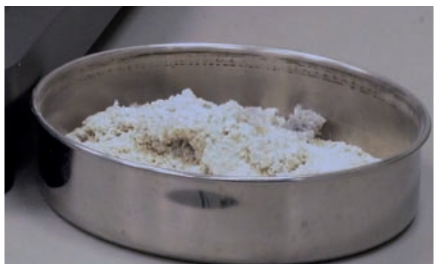

Figure 5. Ground sample.

Note

In principle, it is possible to achieve a maximum final fineness of the ground sample of < 80 µm when using the Variable Speed Rotor Mill PULVERISETTE 14 premium line.

Third test

In the third test, a part of the pre-comminuted sample from the PULVERISETTE 19 LARGE was further comminuted in the Planetary Mill PULVERISETTE 5 premium line. The grinding time was one minute, the instrument was operated with 125 ml volume zirconium oxide grinding bowls as well as 20 mm zirconium oxide grinding balls. The speed of the sun disk was set to 450 rpm, the final fineness achieved was < 100 µm.

Note

The PULVERISETTE 5 premium line, has the advantage, as it is a closed system, that no harmful substances can be inhaled during the grinding process.

Furthermore, the mill offers the possibility to achieve final fineness of samples down to the nano range.

Figure 6: PULVERISETTE 5 premium line with ZrO_2 accessories.

Conclusion

With the conducted tests Fritsch could show that there are different solutions in the portfolio to comminute catalysts. In a further analysis, the user can determine, for example, how high the precious metal content is in the milled material, in order to decide whether there is potential to recover the precious metals.

Reference

1. Wikipedia Fahrzeugkatalysator

Watch the Video "Processing a catalytic converter in the FRITSCH laboratory": https://www.youtube.com/embed/AtKM89FF-yc?rel=0

New Line of Bench Meters Enable Easy Electrochemistry Testing

The newly launched **Thermo Scientific** Eutech 1700 Series Bench Meters offer accurate measurement of pH, conductivity and dissolved oxygen. With user-friendly features and easy-to-use functionality, the Bench Meters are well-suited for teaching, agriculture and industrial labs with varying levels of technical expertise.

"For more than 30 years, Eutech instruments have set the standard for quality and performance in analytical testing, empowering customers to meet a wide range of application needs," said Mayoorathan Maheswaran, Senior Research and Development Manager at Thermo Fisher Scientific. "The latest addition to the Eutech portfolio builds on a proven track record of internationally recognised achievements in sensor technology, software programming and product design to allow all users, from novice to experienced, to produce accurate readings with confidence."?

Thermo Scientific Eutech 1700 Series Bench Meters have a small footprint (187.2 mm x 155.2 mm x 61.7 mm), using up less room in the lab workspace and storage areas while bringing intuitive operations and durable construction to the benchtop. The adjustable electrode holder attaches to meter and firmly grips each electrode for greater stability and facilitates movement into and out of samples. A backlit display allows users to quickly read and record sample measurements. Data logs and calibration logs are date and time stamped for GLP/GMP reporting.

Certified to comply with various global testing standards, Eutech instruments pioneered the inclusion of application-specific integrated circuits (ASIC) and are manufactured in Singapore, Asia's design and technology hub.

More information online: ilmt.co/PL/WyWa

For More Info, email: 59155pr@reply-direct.com

Automated Environmental Titration and Multi-Parameter Analysers

The new MANTECH MT series AM400 autosamplers from **QCL** save space and lower the cost per sample. The analysers can be configured as a simple pH system or with up to eight parameters. Systems are tailored with off-the-shelf modules to meet requirements for sample volume, parameters and sample size.

The MANTECH MT series autosamplers are optimised for water, soil, food and beverage analysis and each system is fully automated for up to 720 samples in a single batch. Advanced features include Titrasip™ automated pipetting allowing two or more titration methods from a single sample cup, and IntelliRinse™ to prevent cross contamination between samples.

The systems are controlled by MANTECH Pro lab automation software. Easy-to-use it includes a variety of features to improve database sharing and management, automation of controls and alerts, hardware and software communication, shortcut customisations and more.

More information online: ilmt.co/PL/j4Qg and ilmt.co/PL/RyMR

For More Info, email: 57600pr@reply-direct.com

LDIR Chemical Imaging System for Microplastics Analysis

The enhanced 8700 LDIR Chemical Imaging System from **Agilent Technologies** has been further optimised for the analysis of microplastics in environmental samples. This newly improved package includes Clarity 1.5 software - a significant upgrade that advances the speed of analysis, enhances spectral acquisition, transformation, and library matching, and provides automated workflows for direct analysis of microplastics on a filter substrate. An innovative, redesigned sample holder allows the on-filter sample to be presented to the instrument more easily and consistently.

Slow and complex analysis solutions are a major challenge to microplastics analysis and have hindered studies of real-world systems. Additionally, method variability limits the comparability of studies, making trends difficult to assess. Vibrational spectroscopy methods such as FTIR and Raman microscopy provide a useful alternative, but each faces limitations due to the excessive time of analysis and method complexity.

The Agilent 8700 LDIR brings high-speed analysis and ease of use to infrared spectroscopy and has rapidly emerged as the benchmark technique for the analysis of microplastics particles. The development of on-filter analysis for this platform marks another leap forward in speed and throughput. The ability to significantly increase testing volumes will allow a greater understanding of the extent of microplastics contamination in the environment and will help facilitate the development of appropriate standards and regulations.

Geoff Winkett, Vice President and General Manager for Agilent's Molecular Spectroscopy Division, discussed the announcement's impact. "When I speak with microplastics researchers, a recurring question is how to make testing faster and easier, as there is a real concern that the limited sample numbers that can be realistically processed may be masking the true nature of the issue," he said. "The fact is that other currently available techniques are too slow and cannot capture the extent of the microplastics load in drinking and environmental waters. Fast and easy-to-use analysis methods such as the 8700 LDIR provide an essential and much-needed alternative that enables researchers to increase sampling over area or time to address these limitations."

More information online: ilmt.co/PL/30y0

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