DIESEL INTERNATIONALC/O VADO E TORNO

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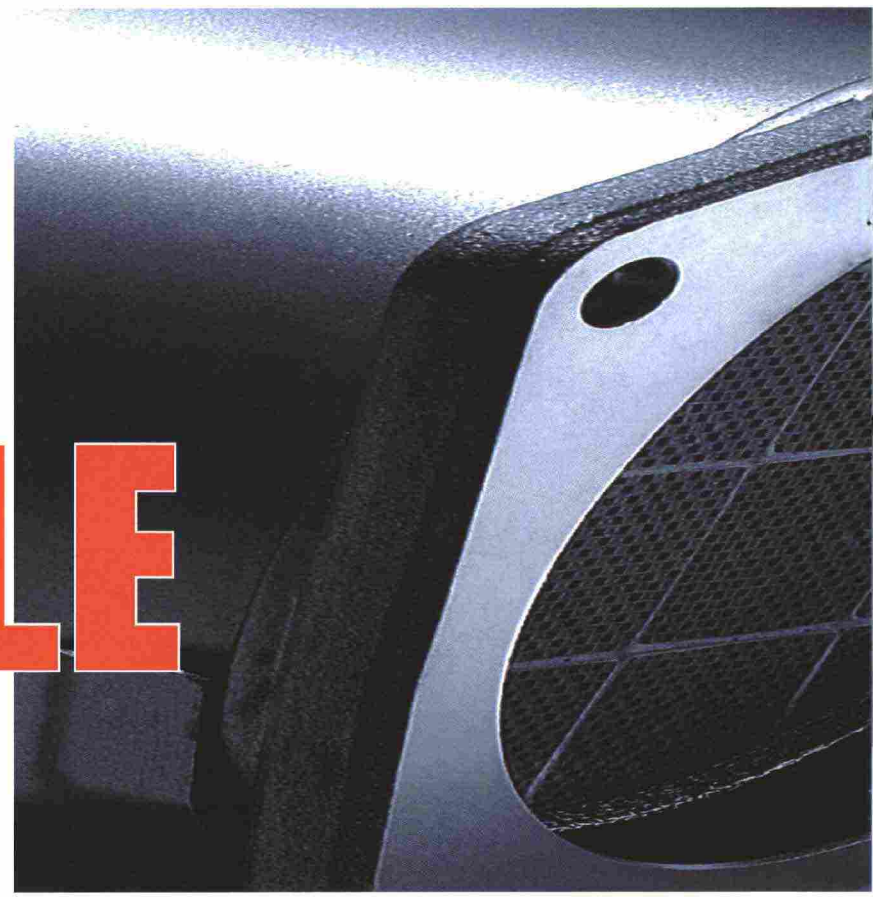
PARTIAL PGMS

COPPER TOO IS NOBLE

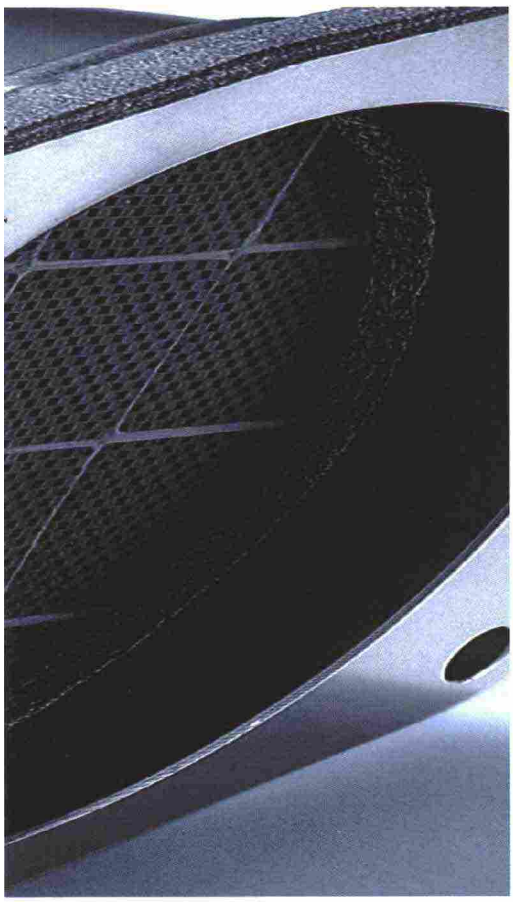


After-treatment as the key to Stage IV and Stage V and a variable which increases prices, dimensions and issues. The Partial-PGMs project was born from these assumptions. We asked Isella **Vicini**, Head of European Funding Division at Warrant Hub (Tinexta Group), to tell us more.

A short technical-chemical overview about the differences between rare-earth elements and copper…

Unlike their name suggests rare-earth elements are not so rare but the extraction and processing cycle is dangerous, difficult and impactful, so only a few nations, such as China, have decided to continue their mining, holding in fact a monopoly. Rare-earth elements are usually known for their physical properties (magnetic, optical) while copper is an excellent catalyst. In the Partial PGMs project rare-earth elements were used to build only the frame of the active supports for catalysis on which the copper particles are settled. It is worth pointing out that the rare earths used are those (lanthanum, for example) which are now substantially discarded being not suitable for their physical properties. The Partial PGMs project is therefore a low environmental and economic impact solution. The function of rare earths is synergistic to that of copper, allowing the copper nanoparticles to settle and increasing their reactivity and exchanging oxygen with the gas mixture. The amount of oxygen needed is well defined and regulated by

The goal of the so-called Partial PGMs project is to create a hybrid particulate filter using less rare-earth elements, which are used to build only the frame of the active supports for catalysis.
This project, officially endorsed by the European Commission, is based on the use of copper as a noble metal



Isella **Vicini**, Head of European Funding Division at Warrant Hub

HORIZON 2020 is the biggest EU Research and Innovation programme ever with nearly €80 bn of funding available over 7 years (2014 to 2020), in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market

the lambda probe: the ability of the support to store and transfer oxygen facilitates this function at a microscopic level.

In addition to the previous question, what percentage of platinum and rare-earth elements is needed and what function do they perform compared to copper?

Platinum is the catalyst par excellence, widely used in the industry; in the case of the Partial PGMs project it allows to lower the temperature at which the conversion process starts. It is particularly important to avoid pollution when the converter has not yet reached its normal operating temperature, a problem that could be relevant in hybrid engines where intermittence can make difficult to reach the optimum temperature of the catalytic converter. Platinum constitutes the 0.5% of the overall weight. The only rare earth used is lanthanum that is used to build the frame of the material that holds the copper nanoparticles. The quantity is slightly higher than 10% but being a heavy element its weight percentage is over 60%. But it should be remembered that lanthanum is a waste element from the mining of those precious and currently non-replaceable rare earths used for magnetic resonance imaging, lasers, etc., therefore its availability is not a problem. It is also a non-toxic and non-polluting element.

What does 'hybrid filter' mean?

Traditional filters perform a mechanical action to collect the soot which is then processed essentially by combustion and converted into carbon oxides. In the Partial PGMs project, on the other hand, the active material deposited on the filter converts the soot and at the same time reduces gaseous pollutants.

What 'new and innovative nano-structured materials with low PGM and REE content' are exactly?

These materials feature an innovative formulation which was specifically developed for the Partial PGMs project and attempt to reduce the quantity of elements considered critical (for cost and/or availability reasons) by the European Community and hence might slow down the industrial development. These are composite materials in which the greater reactivity of the nanodimensional copper particles settled on a support with low environmental and economic impact has been exploited. Copper is less active than PGMs but its reactivity has been increased thanks to the use of nanodimension. This is a property that always applies to nanometer-sized materials: even gold, for example, which is considered a noble and unreactive metal, becomes very active when nano-sized. In the Partial PGMs project this property was exploited to increase the catalytic capacity of copper.

What is planned for the disposal of nano-materials and copper?

Disposal, environmental impact and recycling were analyzed during the project by specialized research groups and the recyclability of the materials was verified. Copper nanoparticles can be separated from the support oxide and recovered. It should be noted that the technical feasibility must then be compared with the economic one.