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New Catalyst for Diesel-Fueled Vehicles Developed

New Silver Catalyst Purifies Diesel Emissions and Reduces Costs

Mitsui Mining & Smelting Co., Ltd. (President: Yasuhiko Takebayashi) has successfully developed a new catalyst that uses silver instead of the platinum used with conventional catalysts, to purify emission gases from diesel engines. The use of silver, which is less expensive than platinum, enables the cost of rare metals to be reduced by at least 90% while retaining the same capacity to purify particulate matter (PM) as that found in conventional catalysts.

Significant reduction in rare metal costs

The new catalyst features the use of inexpensive silver. The catalyst is applied to the emission gas purification filter, known as the diesel particulate filter (DPF; *Note 1), for combusting and removing PM emitted from diesel engines at low temperatures. The new catalyst enables the cost of rare metals, as a component of the sales price, to be reduced by at least 90%, as inexpensive silver is used in place of the conventional platinum.

Many of the catalysts for diesel emission gases now in practical application use platinum, for which prices have remained at exceptionally high levels. The reduction of rare metal costs has consequently been a major issue. Until now, the practical application of metals other than platinum was considered difficult because none of the substitutes provided adequate purification capacity or durability.

Mitsui Mining & Smelting established the technology to stabilize silver even at high temperatures by combining silver with oxides of metallic compounds. This led to the successful development of the new catalyst. The test results have confirmed that the new catalyst has

thermal resistance up to about 800ºC. Evaluations in actual engines have been conducted, confirming that the capacity to combust PM is not inferior to that of conventional catalysts using platinum.

Superior soot combustion capacity

The new catalyst is capable of absorbing and emitting oxygen at a higher level than platinum catalysts, thereby enabling the soot to be combusted effectively by the activated oxygen on the catalyst surface. The combustion reaction enables PM to be combusted only in oxygen, which differs significantly from combustion with platinum catalyst, in which nitrogen oxides (NOx) contained in the emission gases is used (*Note 2).

Under combustion conditions with no NOx, elevated temperatures of at least 600ºC are needed to combust PM using conventional platinum catalysts. The new catalyst using silver is able to discharge oxygen at lower temperatures, enabling the combustion of PM at lower temperatures of around 400ºC. The new catalyst reduces PM even with a smaller amount of NOx when used with actual engines, so its applications are expected to expand.

Targeting the industrial machinery market, where the regulations are becoming more stringent

Emission gases from diesel engines have been regulated for trucks, buses and passenger vehicles in that order of priority. They have been equipped with systems for treating emission gases that utilize DPF catalysts and urea SCR catalysts (*Note 3), as well as oxidation catalysts (DOC). On the other hand, regulations will be strengthened in Japan, North America and Europe from 2012 onwards for construction machinery, farm equipment, power generators and other industrial machinery. To comply with the new PM regulations, it is necessary to equip the engines with DPFs, and the market for the catalyst system is estimated to be worth about 50 billion yen.

Given the expanding catalyst market, Mitsui Mining & Smelting plans to develop new silver catalysts for the diesel engines used in industrial machinery.

The catalyst business and future prospects

Mitsui Mining & Smelting started its catalyst business in 1976 with the volume production and commercialization of Japan’s first honeycomb catalyst for automobiles. Since then, the Company has manufactured and sold catalysts mainly for automobiles and motorcycles. Particularly noteworthy is the fact that the Company has achieved the world’s largest share of the motorcycle catalyst market.

To expand its catalyst business, Mitsui Mining & Smelting is striving to enter the diesel emission catalyst market using the new silver-based catalyst. It is also considering developing the

same catalysts for the truck and passenger vehicle market.

*Note 1. Diesel Particulate Filter (DPF): A filter for collecting particulate matter (PM); many of these devices are made from cordierite, silicon carbide and other ceramics.

*Note 2. Combustion with nitrogen oxides (NOx):

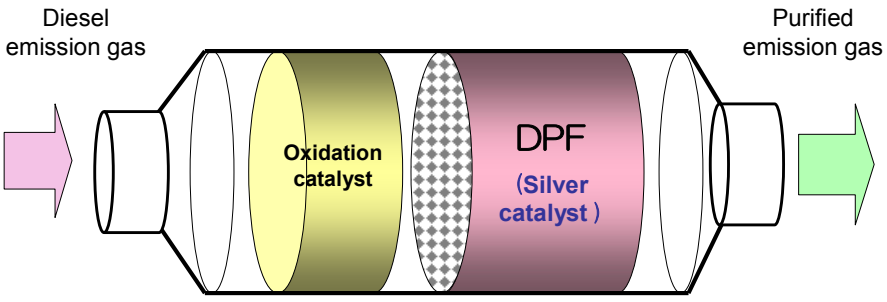
A concentration of NOx in the emission gas that is greater than the theoretical reaction quantity is necessary with platinum catalysts, as soot is burnt with nitrogen dioxide (NO_2). It is difficult to combust PM when the NOx concentration is low.

*Note 3. Urea SCR:

A catalyst that removes NOx by decomposing it into harmless nitrogen and water using urea as a reduction agent; the catalyst is used mainly on large trucks, as it enables NOx reduction without affecting the mileage.

Reference

Example of the Use of Silver Catalyst



※DPF: Diesel particulate filter

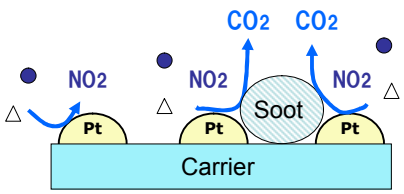
How the Combustion Mechanism Differs from That of the Conventional Catalyst

Platinum catalyst

(conventional products)

● :Oxygen

△ :NO



Silver catalyst

(new product)

● :Oxygen ＊O:Activated oxygen

△ :NO