compounds, with the catalytic activity dependent on the polarising current density.

Conclusion

This conference provided an excellent opportunity for the international community to examine the extent of the development of metal-hydrogen technology within the CIS. Hydrogen phase naklep, diffusion membrane and membrane catalysis technology based on palladium are examples where work carried out in the CIS constitutes the "state of the art". These areas therefore appear likely to continue to attract growing international attention in the future.

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Reduction of Nitrogen Oxides by Hydrocarbons

PERFORMANCE OF PLATINUM METALS CATALYSTS INVESTIGATED

The removal of nitrogen oxides present in the gases emitted from sources such as electric power generation boilers, stationary internal combustion engines and gas turbine engines—all of which are likely to use excess oxygen to achieve maximum fuel efficiency—can be achieved by a selective reduction process using ammonia as the reducing agent, the reaction being carried out over a base metal oxide catalyst. It had been considered that hydrocarbons were ineffective for this reaction but recent work has indicated that with suitable catalysts it may be possible to use them in a process which removes nitrogen oxides from the exhaust gases of both diesel and lean-burn gasoline-fuelled engines. For practical application, high activity under high space velocity and also high selectivity would be required.

The activity and durability of a variety of catalysts have been investigated, but to-date there has been only little interest in using the platinum metals as catalysts for this purpose. Now, however, a team at the National Institute for Resources and Environment, Tsukuba, Japan, have investigated the performance of platinum, palladium, rhodium, iridium and ruthenium supported on γ-alumina as catalysts for this application (A. Obuchi, A. Ohi, M. Nakamura, A. Ogata, K. Mizuno and H. Ohuchi, "Performance of Platinum-Group Metal Catalysts for the Selective Reduction of Nitrogen Oxides by Hydrocarbons", *Appl. Catal. B: Environ.*, 1993, **2**, (1), 71–80).

The addition of some hydrocarbons to the exhaust is necessary to compensate for the greater amount of nitrogen oxides generally emitted from combustors operating under net-oxidising conditions, and the properties of propene favour its use as the reducing agent. With both model mixtures and real diesel exhaust gases it was found that platinum-rhodium/γ-alumina displayed high activity for nitrogen oxides conversion, at 200 to 350°C. These catalysts are similar to the three-way catalysts used for controlling emissions from gasoline fuelled engines. It is concluded that platinum metals catalysts will find practical usage for this purpose, especially if their selectivity to nitrogen is improved.

Nanoscale Platinum Technology

As microelectronic device and computer components are reduced to sub-micron size there is a need for metal features of nanometre thickness. At the Naval Research Laboratory, Washington, a method has been developed for fabricating platinum patterns of varied geometry which may be as little as 20 nm thick and with heights of up to 700 nm. These are produced by thermal decomposition of a platinum precursor molecule, tetrakis-(trifluorophosphine)-platinum, onto the surface of a contoured substrate. A detailed description of the fabrication process, and an analysis of the properties and morphology of the platinum film structures have recently been published (D. S. Y. Hsu, N. H. Turner, K. W. Pierson and V. A. Shamamian, *J. Vac. Sci. Technol. B*, 1992, **10**, (5), 2251–2258).

The substrate is amorphous silicon, fabricated by lithographic techniques suitable for large scale processing, and this permits a very thin polycrystalline platinum film to be deposited, which in turn makes possible the production of ultranarrow patterns with 20 nm linewidths. It is suggested that further reduction in linewidth is possible by improving various parameters.