Additional "TriM" Materials

Although ZGS Platinum "TriM" is still being introduced to potential users other "TriM" materials are already under consideration by Johnson Matthey. These would provide different properties and include composites with surface layers of ZGS 10 per cent rhodium-platinum for even greater strength, and ZGS 5 per cent gold-platinum outer layers to decrease wetting by molten glass (6).

Conclusion

ZGS Platinum "TriM" composites are new materials offering many industrial users of platinum considerable benefits including lower metal costs. Present and future developments of noble metal composite materials will widen their industrial application with worthwhile advantage to the customer.

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"TriM" is a Johnson Matthey Trade Mark.

References

1 A. S. Darling, *Platinum Metals Rev.*, 1973, **17**, (4), 130–136
2 G. L. Selman, J. G. Day and A. A. Bourne, *Platinum Metals Rev.*, 1974, **18**, (2), 46–57
3 G. L. Selman, J. G. Day and A. A. Bourne, *Platinum Metals Rev.*, 1976, **20**, (3), 86–90
4 *British Patent Appl.* 2,107,378; 1983
5 J. D. Barrell, *Platinum Metals Rev.*, 1982, **26**, (1), 13–15
6 A. E. Heywood and R. A. Benedek, *Platinum Metals Rev.*, 1982, **26**, (3), 98–104

A Review of Catalytic Combustion

One of the most important applications of platinum group metals catalysts is for catalytic combustion, an improved, flameless, combustion process. Since traditional flame combustion or oxidation occurs only within specific air:fuel ratios and often produces pollutants it can be hard to control and may be incomplete. The use of a heterogeneous catalyst allows greater control of oxidation over a wide range of air: fuel ratios, and less pollutants are produced. In operation, the mixture of fuel and air is passed over the catalyst at a temperature which is sufficiently high to allow total oxidation to occur. With the correct catalyst technology this temperature is significantly lower than that required when the catalyst is not present. The reaction that occurs on the catalyst surface liberates both energy and the products of combustion. For hydrocarbon fuels the latter are carbon dioxide and water, which may be discharged to the atmosphere.

Catalytic combustion is used in a number of applications. The prime reasons for the combustion may be either to liberate energy in catalytic heaters, catalytic boilers and catalytic gas turbine engines, or it may be to remove or limit the formation of pollution by the use of car exhaust catalysts or industrial catalytic clean-up units. A most useful and readable review of the whole field of catalytic combustion, by Professor D. L. Trimm of the University of New South Wales, has recently been published in *Applied Catalysis,* 1983, 7, (3), 249–282.

This review concentrates on some of the less well known applications of catalytic combustion in low and high throughput units. For many of the applications one, or more, of the platinum group metals forms the preferred catalyst.

Gas turbines require a hot gas stream as their power source and this can be provided by catalytic combustion. The review covers in detail the published work in this field, giving information on the catalyst systems that have been used. The major advantages of catalytic combustion demonstrated are the reduction in the amount of nitrogen oxides formed when combustion occurs at temperatures less than 1650°C and the ability of catalytic combustion to take place with leaner air:fuel ratios than are required for flame combustion.

The various washcoat systems that are used to provide the high surface area upon which the catalytic metal can be deposited are considered; these include the favoured monolithic, or honeycomb, supports. The review, which also covers the kinetics of catalytic combustion, a consideration of low and high throughput systems, heterogeneous-homogeneous combustion and the use of alternative fuels, includes 133 references.

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