

substrate were available for recycling; this contained 400 kg of platinum and 70 kg of rhodium. In Germany the number of cars sold with catalytic converters has risen from 50,000 in 1985 to 3.3 million in 1992. Hagelüken estimated that by the end of 1994 there were 40 million catalyst-equipped vehicles in Europe and this would increase by 10 million cars during 1995. At present some 8 million cars are scrapped each year, but very few are fitted with converters.

Hagelüken reviewed the system of returning scrap catalytic converters to the precious metal refiner as well as the hydrometallurgical and pyrometallurgical methods of platinum group metal recovery and separation. By the year 2000

it is anticipated that 3,500 to 4,000 tons of autocatalyst substrate should be available annually for platinum group metal recovery.

In conclusion, continuing advances in the precious metals industries, even since the first Eurometaux conference was held in 1993, together with the driving force of legislation to cope with levels of pollutants in the environment, will ensure that the interest in innovation within the European refining and fabrication industries for noble metals, remains at a high level. The Proceedings of the Conference will not be published, but papers may be obtained from Eurometaux, Av. de Broqueville, Brussels, Belgium.

G.C., P.D., R.A.S.

A Comprehensive Commentary on the Platinum Metals

The Platinum Group Metals: A Global Perspective

BY C. F. VERMAAK, Mintek, South Africa, 1995, 247 pages, U.S.\$100.00, ISBN 0-86999-926-5

Frank Vermaak, a prominent South African geologist, has undertaken the daunting task of writing a comprehensive overview of the geology, production and consumption of the platinum group metals. His aim is to provide a down-to-earth review, accessible to a wide audience, of all aspects on the platinum group metals and to suggest future developments.

With his long experience in the platinum industry, Dr Vermaak is ideally placed to provide a thorough review of world resources and production of platinum group metals; and he devotes the first half of the book to this, outlining the occurrence of these metals in deposits across the world. He then considers output by producer, and concludes with a discussion of the technical issues involved in mining, beneficiation and refining. Much of this section concentrates upon South Africa, but there is also extensive information on platinum group metal resources and production in the U.S.A., Canada, China and Australia. This section performs a valuable service in bringing together information on smaller producers which, because of their relative insignificance in terms of total world supply, are not often reviewed elsewhere. He also includes a long discussion of platinum group metals deposits and output in Russia, although he admits that "vital data on tonnage and grade remain pretty much guesswork".

One chapter examines the marketing, distribution, trading and pricing of platinum group metals, especially up to 1992, with graphs showing the long-term price trends. Dr Vermaak also

discusses trends in world consumption of platinum group metals between 1981 and 1992, providing detailed tables of usage by region and by application.

The latter part of the book provides an introduction to the many applications of the platinum group metals. One chapter discusses catalysis, and covers development and manufacture of autocatalysts and reviews environmental legislation. However, due to the extended timescale required for the production of such an ambitious treatise, Stage II European Union emissions standards and the improvements in catalyst technology which have permitted increased use of palladium in autocatalysts are not mentioned. Another chapter deals with chemical, glass and electronic applications.

Finally, Dr Vermaak examines future demand and supply of the platinum group metals. He devotes a chapter to the prospects for significant platinum usage in fuel cells; there is detailed discussion of the different types of cell, their potential applications, and progress towards commercialisation. The book ends with an examination of the social, political and economic factors influencing the outlook for demand and supply, concentrating upon the impact of the political changes in South Africa and Russia.

"The Platinum Group Metals" is a valuable addition to the literature on this subject. It should prove particularly useful for the reader seeking an expert overview of the background, geology and resources, and the uses to which the platinum group metals are put.

A.J.C.