Tenth International Precious Metals Conference

SELECTED PLATINUM METALS PAPERS REVIEWED

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On 8th to 12th June 1986, the International Precious Metals Institute celebrated its tenth anniversary with its annual conference. This was held at the Hyatt Lake Tahoe Hotel in Incline Village, Nevada, the purpose being to bring together worldwide specialists in all phases of the precious metals industry for an exchange of information.

The meeting was attended by 456 people who came from 26 of the 50 states in the United States of America and from 17 other countries. The technical sessions included 68 papers in 12 sessions covering such subjects as recovery of precious metals from primary as well as from secondary sources, evaluation of analytical procedures, environmental considerations, economics and various applications.

Fuel Cell Technology

The application of platinum group metals in fuel cells was reviewed with a discussion of some technical developments and estimates of the requirements for platinum in the next two decades. Maynard K. Wright of the Westinghouse Electric Corporation in Pittsburgh, Pennsylvania, reported that the company's objective is to commercialise phosphoric acid fuel cell technology in the 1990s. If successful, the estimated cumulative platinum requirements for their programme would reach some 850,000 troy ounces by the year 2005.

And the year 2005 has some significance because estimates of phosphoric acid fuel cell development, presented by A. J. Appleby of the Electric Power Research Institute in Palo Alto, California, project that this production will peak in the years 2005 to 2009, by which time more efficient fuel cell systems using non-noble metal catalysts may have captured much of the market.

Philip N. Ross of the Lawrence Berkeley Laboratory in Berkeley, California, pointed out that commercial use of fuel cells was dependent on more efficient use of platinum than was possible with the platinum-black deposit as prepared by the Adams method. With improved technology, such as deposition of platinum by adsorption from colloids rather than by electrodeposition, a remarkably uniform distribution of platinum crystallites can be obtained. With this, and with engineering improvements in electrode technology and stack engineering at United Technologies, platinum loadings have been reduced by two orders of magnitude with no sacrifice in performance.

Satoshi Motoo of Yamanashi University in Japan discussed the theoretical performance of gas diffusion electrodes for fuel cells and electrolytic cells. This ties in with a programme by Prototech Company in Newton, Massachusetts, to replace the conventional lead anode used in electrowinning zinc with a hydrogen diffusion anode (HDA). Amiram Bar Ilan of Prototech described a development programme in West Germany to demonstrate the benefits of this substitution which is reported to save more than one-half the DC energy at the expense of hydrogen, eliminate acid mist, and alleviate cooling requirements. They propose to retrofit existing plants as well as to use HDAs in new plants where even greater benefits could be realised. Since the HDAs generate hydrogen, this could be used in hydrogen-air fuel cells to generate all the electricity needed for the zinc tankhouse. The platinum requirement to

retrofit substantially all existing zinc tankhouses with HDAs is estimated to be of the order of 130,000 troy ounces.

Z. George Swiatek of Diesel Controls Ltd., Ontario, Canada, described the construction and performance of a metallic substrate as a honeycomb platinum catalyst support for a catalytic converter to purify diesel engine exhausts. Called a Mine-X design, the converter is superior to units using a ceramic honeycomb due largely to its higher thermal conductivity which provides better distribution of heat. Advantageously, the units can be brazed to the container.

Coatings for Refractories

Interest continues in using platinum group metals as protective coatings particularly against high temperature oxidation of refractory substrates. Richard P. Walters of the U.S. Bureau of Mines described work on the electrodeposition of platinum group metals in molten cyanide. An equimolecular mixture of sodium and potassium cyanide was used. Thick platinum coatings produced were adherent and fully ductile, but not pore free. The researchers suggest laser processing to reduce porosity.

John T. Harding of Ultramet in Pacoima, California, coated refractory metals with iridium, platinum and rhodium from acetylacetonate compounds by chemical vapour deposition. Of these, iridium was preferred and claims of effective protection in air at 2000°C over 5 hours were made. Work is continuing with alloys of these three metals.

Petroleum Refining

While not all of the steps in the refining of fossil fuels (gas, coal and petroleum) into fuels or chemicals use noble metal catalysts, these are essential in many of the steps. The subject is too complex for a useful short summary. For example, in petroleum refining there are 25 to 35 different commercial platinum catalysts available. All consist of platinum on alumina.

Those used in petroleum refining were described by Arthur H. Neal, Exxon Research and Development Laboratories in Baton Rouge, Louisiana, while precious metals used in the production of petrochemicals were described by R. J. Farrauto of Engelhard Corporation in Edison, New Jersey.

In petroleum refining, platinum catalysts are particularly necessary for the paraffin isomerisation and catalytic reforming processes which are important in the production of high octane motor gasoline. Iridium and palladium also are used as catalysts. Recovery of these catalysts is high, however, and demand for platinum group metals in this industry is modest compared with other industries.

For petrochemicals, the precious metals used as catalysts are primarily composed of platinum, palladium, rhodium, or silver, and sometimes a combination of these or other metals. Catalysts may consist of platinum metals plated on carbon particles or alumina honeycomb, or as wire mesh screens. Homogeneous catalysts of noble metals (those dissolved in the reactant phase) are also used, but only in a very few processes.

Related to petrochemicals was a paper by T. A. Koch of E.I. du Pont de Nemours in Wilmington, Delaware. Dr. Koch described research to understand and improve the behaviour of rhodium-platinum catalysts used in the manufacture of hydrogen cyanide from methane and ammonia. While consistency in performance of these catalysts was improved somewhat by tighter limitations on impurities, especially iron, no solution to the problem of rapid deterioration in catalyst performance was found. Research, however, disclosed that there is rapid restructuring of the platinum alloy which produces dislocations and voids which result in expansion in the volume of the wires in the mesh.

Of the 68 papers presented, 48 (in whole or in part) were bound in book form prior to the conference. The book is available from the International Precious Metals Institute, Government Building, ABE Airport, Allentown, Pennsylvania 18103. The price is $25 for IPMI members, $35 for others, plus $2.50 for postage and handling a single copy and $0.75 for each additional copy.