Recovering Spent Autocatalysts

Precious and Rare Metal Technologies, Process Metallurgy 5

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This volume contains a selection of papers presented in April 1988 at the Symposium on Precious and Rare Metals, which was held in Albuquerque, New Mexico, to consider advances in the geology, mining and extractive metallurgy of the titled metals. The proceedings are divided into five sections: Gold and Silver, Platinum Group Metals, Rare Earth Metals, Gallium and Germanium, and Light Metals.

The manufacture of automobile emission control catalysts is the largest single use for platinum, and catalytic converters salvaged from vehicles at the end of their lives are regarded as a potentially important secondary source of platinum, and also of palladium and rhodium. However, the quantities currently being recovered are still only a small part of the amounts that should, in theory, be available for reprocessing. This is due to a number of factors, including the less than perfect refining technology used to recover the platinum metals from the catalytic converters. The latter is addressed in this useful volume, in three of the four papers that comprise the 70 page section on the platinum group metals.

The fourth chapter is a summary by E. G. Baglin of investigations carried out by the U.S. Bureau of Mines on platinum-palladium ore from the Stillwater Complex, Montana. This is the only resource of primary platinum group metals currently being mined in the U.S.A. The Bureau has developed alternative techniques for processing the concentrate from the on-site flotation mill, should domestic recovery become desirable for economic or for strategic reasons.

The difficulties of recovering platinum group metals from catalytic converters is attributable, in part, to the chemical behaviour of the ceramic pellet or monolith support and also to the contaminants present in spent catalysts, which include lead, carbon and chloride compounds. Total dissolution of the catalyst, preferential solubilisation of the platinum group metals, a dry chlorination scheme and three pyrometallurgical processes are described by J. E. Hoffmann, who tabulates their advantages and disadvantages.

The results of an academic study of platinum and palladium recovery from spent converters by leaching with mixtures of hydrochloric and nitric acids in both packed and fluidised beds are reported by R. G. Bautista, L. Yue and D. R. Tyson. For the packed bed experiments a sieved fraction of a ball-milled ceramic monolith that had served for 10,000 miles was used. The very high initial rate of leaching indicated that a multi-stage leaching operation may be advantageous. The fluidised bed tests were made on spherical catalyst pellets after use over 90,000 miles. In this type of catalyst the concentration of platinum and palladium is very low, compared with monolithic supported catalyst, and in the fluidised bed the time to obtain over 90 per cent extent of reaction, for both elements, was shorter than in the packed bed reactor.

The development by Platinum Lake Technology of a proprietary chloride-organic leach process which is e.m.f. controlled to enhance the oxidative dissolution of the platinum group metals, is reported by V. I. Lakshmanan and J. Ryder. A reductive treatment precedes the leaching, and the leaching includes the use of an inorganic chloride compound, an inorganic acid component, a proprietary additive and an oxidant. The metals are recovered from the leached solutions by solvent extraction and selective stripping. Following a test programme at the Ontario Research Foundation, a flowsheet to recover platinum group metals from spent catalysts has been developed. I.E.C.