# *34th Annual Conference of Precious Metals*

A strong theme of sustainability at the IPMI's annual conference

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On 12th June 2010 over 500 delegates from around the world met at the JW Marriott Starr Pass Resort in Tucson, Arizona, USA, for the 34th Annual Precious Metals conference of the International Precious Metals Institute (IPMI) (1). The resort, located close to the magnificent Saguaro National Park and its forests of giant cacti, overlooks the historic city of Tucson.

The technical programme consisted of either two or three parallel sessions on each day of the conference with the most relevant sessions to platinum group metals (pgms) being:

- Session C: New Trends in Refining and Analyzing Precious Metals;
- Session E: The Future of Precious Metals: Business and Technology;
- Session F: Analysis of Precious Metals;
- Session G: New Technology/Recovery and Refining of Precious Metals.

There was a strong theme of sustainability with many talks revolving around recovery and recycling of pgms and pgm-containing materials.

## Recovery and Recycling of PGMs

Thomas Trin (W. C. Heraeus GmbH, Germany) spoke about the increasing need for innovative metal recycling technologies. This is partly due to a wider variety of materials with differing levels of pgm content becoming available for recycling, and partly due to changing economic and legislative conditions. Specific examples of platinum and ruthenium recovery from magnetic data storage media and emerging gas to liquid (GTL) or coal to liquid (CTL) catalyst systems using platinum and ruthenium were given. Two Heraeus processes were described, namely HeraCYCLE®, a proprietary thermal reduction process which allows accurate sampling and precious metal content determination after milling, and HeraSAMPLE®, a new method of providing accurate sampling for precious metal content determination prior to thermal reduction. In addition, Heraeus in collaboration with PhosphonicS™ Ltd offers precious metal scavengers to improve metal recovery from

low-grade process and waste streams containing from 1 ppm to 500 ppm precious metal.

Christian Hagelüken (Umicore Precious Metals Refining, Germany) provided an update on changes in precious metals refining since the shock of the financial crisis in 2008. Precious metal prices have since recovered to a great extent from the sharp downturn due to demand, underlining once again the role that precious metals play in many important technologies. In parallel, there have been growing concerns about their long-term availability. After comparable exercises in Japan and North America, in November 2008 the European Commission started the Raw Materials Initiative which aims to secure access to 'high-technology metals' including pgms as well as cobalt, rare earth metals and titanium. Improved recycling can make a crucial contribution to ensuring supply security at affordable metal prices.

Steven Izatt (IBC Advanced Technologies, Inc, USA) reviewed general trends in precious metal recycling and presented a number of examples demonstrating the use of molecular recognition technology (MRT) to recover metals from low-grade resources. The increasing use of low concentrations of metals (notably rhenium, cobalt, indium, bismuth, germanium and molybdenum) in association with pgms in catalysis, energy generation, pollution abatement, electronics, and advanced materials, as well as the presence of these non-pgm metals in primary pgm ores of decreasing quality, requires highly efficient separation and purification processes to recover the metal value. Such processes must also be economically viable, be environmentally friendly and have minimal carbon footprints.

Corby Anderson (Colorado School of Mines (CSM), USA) spoke about programmes underway at the CSM Kroll Institute for Extractive Metallurgy (KIEM) and the National Science Foundation (NSF) Center for Resource Recovery and Recycling (CR3). These centres are playing a vital role in furthering the implementation of precious metal recycling in the USA.

Dan Cleroux (Sabin Metal Corp., USA) described the processes in operation for precious metal recovery from low-grade secondaries at SMC (Canada) Ltd, notably from the gravity, magnetic and flotation circuits.

He Xiaotang, Wu Xilong, Han Shouli, Wang Huan and Li Yong (Kunming Institute of Precious Metals, China) described a new process for the preparation of chloroiridic acid from iridium-containing organic waste liquids. The organic waste is first treated with *aqua regia*, thereby transferring iridium into aqueous chloride/nitrate media. Then iridium is separated in the form of $Ir(OH)_3$ and $Ir(OH)_4$ by hydrolysis with sodium hydroxide, followed by dissolution of $Ir(OH)_3$ and $Ir(OH)_4$ in hydrochloric acid. Silica impurities are removed by adjusting acidity, and base metal impurities (nickel, copper and lead) are removed by ion exchange. Pure chloroiridic acid is obtained after further impurities are removed *via* ammonium chloride precipitation, re-dissolving the precipitate in *aqua regia*, and removing nitrate.

Paul Miranda (Center for Advanced Mineral and Metallurgical Processing, Montana Tech of The University of Montana, USA) described the development and application of a mineral liberation analyser for the analysis and quantification of minerals, slags and other phases using back scatter scanning electron microscopic techniques along with energy dispersive X-ray analysis (EDX). Robert M. Ianniello (BASF Catalysts, USA) described results of a research programme to concentrate and recover sub-ppm levels of platinum, palladium and rhodium in mine tailings and high-magnetite ore. The analytical method involves firstly a tellurium collection procedure followed by inductively coupled plasma mass spectrometry (ICPMS) measurement, chosen because of its high sensitivity and dynamic range. Tellurium collection followed by AAS or ICP measurement is considered to provide the best combination of precision, accuracy, speed and repeatability.

## Emerging Applications

Richard Seymour (Johnson Matthey Technology Centre, UK) spoke about the use of patent mapping as a tool for monitoring competitor and customer activity, and identifying new market opportunities and technology trends. The vast and constantly growing volume of global patent data has led to the development of visualisation tools capable of analysing many thousands of patents. Examples of their application in the analysis of the pgm patent literature were presented, including the identification of developing or emerging technologies such as OLEDs and photovoltaic cells, the activities of specific companies, and how technology trends have changed over time. The use of iridium in medical applications was one area identified by the patent mapping exercise (Figure 1).

In an illuminating presentation Sven Jantzen (Umicore Platinum Engineered Materials, Germany) described how Umicore's Process Excellence Model


*Fig. 1. Aureka ThemeScape™ patent map for iridium, showing that there are many patents which involve the use of iridium in medical applications (top right of map)*

has been applied in a number of product and process developments. These included:

(a) Physical modelling for new products used in the specialist glass industry, such as stirrers;

(b) Rhodium-free bushings for the fibre glass industry, which has seen the introduction of FKS platinum, a fine grain-stabilised material with increased mechanical strength, corrosion resistance and creep resistance at lower cost than conventional rhodium-containing materials;

(c) Improved pgm recovery systems for the nitric acid industry, especially suited to high-pressure plants which are particularly subject to pgm losses. The Reconit® catchment gauze from Umicore, a three-dimensional knitted gauze, is a new solution for platinum and rhodium recovery in this process (Figure 2).

Bill Gleason (Center for Advanced Mineral and Metallurgical Processing, Montana Tech, USA) presented his work on autocatalytic electroless reduction of palladium for preparation of membranes for hydrogen purification. The successful adoption of hydrogen as a clean fuel will depend on the development of effective methods of hydrogen purification, such as membrane purification using palladium and palladium alloys. While such membranes have been demonstrated to pass hydrogen while blocking other gas species, work is still required to produce a membrane that is stable, cost effective and durable. Montana Tech is developing a membrane based on autocatalytic reduction of palladium from solution onto a porous substrate. Different palladium salts have been found to give varying substrate coverage, and the self-catalytic reduction reaction gives a range of possible morphologies (Figure 3). While still at a developmental stage, the project has demonstrated that it is possible to produce a cheap, robust, scaleable membrane, offering the potential for a versatile, high-volume hydrogen purification membrane for fuel cell applications.

David Lupton (W. C. Heraeus GmbH, Germany), in his talk reviewing the use of Heraeus' ammonia oxidation catalysts for optimum nitrous oxide ($N_2O$) abatement, began with a history of the Ostwald process since it was first introduced in the early part of the 20th century. Warp-knitted gauzes, introduced in the 1990s, have largely replaced earlier woven gauzes due to their higher mechanical elasticity, tear resistance and increased effective surface area. Since 1996, the Heraeus Functional Total Control (FTC)

 

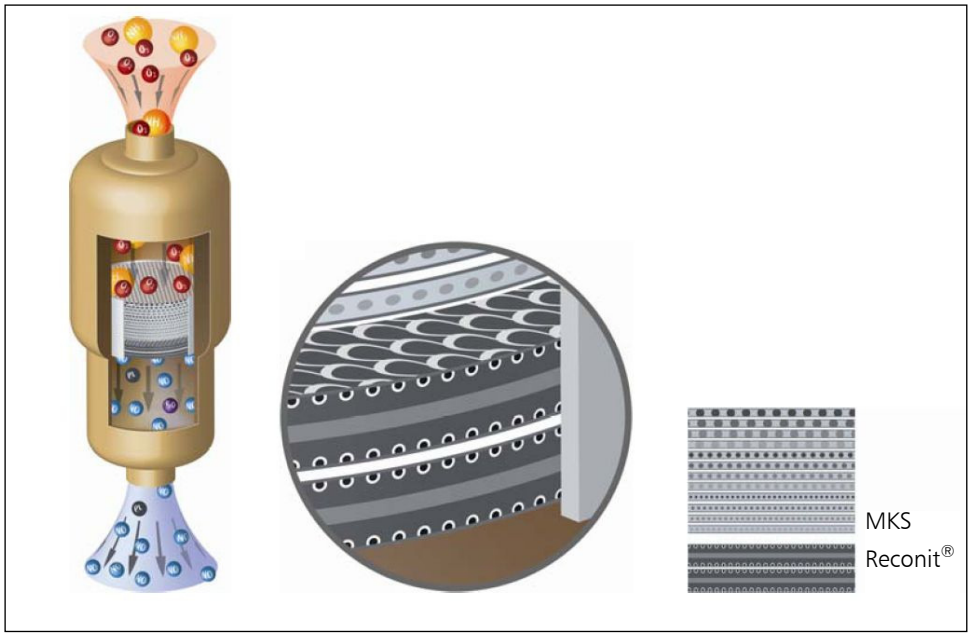


*Fig. 2. High pressure reactor for the catalytic oxidation of ammonia with Reconit® layers below the MKS Modulares Katalysator System™ (Courtesy of Umicore, Germany)*

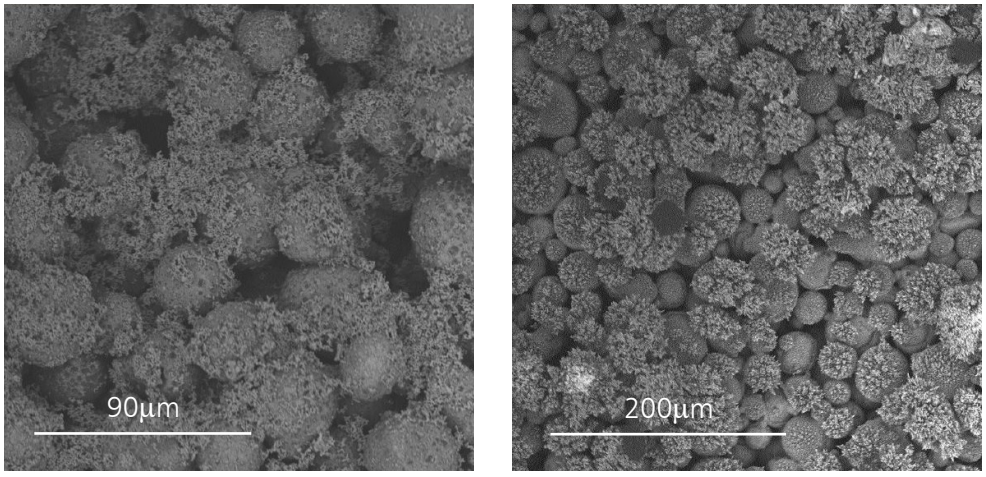


*Fig. 3. Different palladium salts give varying coverage of reduced palladium on a stainless steel substrate (Courtesy of Bill Gleason, Montana Tech)*

system has been commercially available, comprising an integrated gauze/catchment pack consisting of platinum-rhodium gauze at the top and platinum-palladium gauze at the bottom. In 2000, $N_2O$ emissions were reduced by 20–30% over a gauze campaign by the introduction of FTC*plus*, in which a specially designed supported precious metal catalyst is installed immediately beneath the FTC pack. $N_2O$ is a major greenhouse gas, which has 298 times more impact per unit weight than carbon dioxide. The story continues to this day with a new wafer catalyst manufactured not from pgm wires but from fine pgm fibres extracted directly from the melt and sintered to form mechanically stable wafers. Lupton believes this new catalyst will offer the industry a number of new advantages in the future.

 

## IPMI Awards

Among the many award winners were Professor James Dumesic (University of Wisconsin-Madison, USA), who received the Junichiro Tanaka Distinguished Achievement Award for the advancement of the precious metal industry, specifically on spectroscopic, microcalorimetric and kinetic techniques to study the surface and dynamic properties of heterogeneous catalysts, and most recently the use of heterogeneous catalysis for the conversion of renewable biomass resources to hydrogen, liquid hydrocarbons and intermediates for the chemical industry. John Steger (BASF Corp, USA), received the Henry J. Albert Award for contributions to the preparation and application of platinum-, palladium- and rhodium-containing heterogeneous catalysts for emissions control applications.

## Concluding Remarks

The IPMI 34th Annual Conference demonstrated the importance of sustainability in pgm applications, with improved metal recovery and recycling being seen as vital now and for the future. With its record high attendance representing 24 countries, the event was considered to be a great success by all. Conference proceedings have been published and can be purchased from the IPMI (1). The 35th Annual IPMI Conference will be held in San Antonio, Texas, USA, on 11th–14th June 2011 (1).

## Reference

1 IPMI: International Precious Metals Institute: http://www.ipmi.org/ (Accessed on 1 November 2010)

### *The Reviewer*

*Richard Seymour is the Head of Technology Forecasting and Information at the Johnson Matthey Technology Centre, Sonning Common, UK. He is interested in the use of information in the areas of competitive intelligence and commercial development.*

### IPMI Student Awards 2011

The International Precious Metals Institute is accepting nominations from faculty members for its 2011 Student Award Program. The awards will be made to students who have started or plan to do research or development projects in the field of precious metals and will not have graduated before June 2012. There are 7 awards worth US$5000 each. Details of how to apply, the selection criteria and a list of past winners can be found through the IPMI website: http://www.ipmi.org/awards/index.cfm.