

## BERLIN–PM'2010

“Platinum Metals in Modern Industry, Hydrogen Energy and Life Maintenance of the Future”

The Fourth International Conference “Platinum Metals in Modern Industry, Hydrogen Energy and Life Maintenance of the Future” (Berlin–PM'2010) took place from 31st May to 4th June 2010, in Berlin, Germany. The International Organisation “Professor E. I. Rytvin Foundation” was the event's patron and it was supported by the Chamber of Commerce and Industry of the Russian Federation and the International Informatization Academy.

The 60 invited participants included academic and industrial scientists as well as representatives of business groups and public bodies from the UK, Germany, China, Russia, Israel and the Ukraine. The conference programme included 29 reports and communications. All of the papers have been published in the Conference Proceedings (1), which are available from the organisers.

The papers and communications presented at this conference reflect the state of the art in the production, processing and applications of platinum group metals (pgms) and pgm products, with a particular focus on their uses in the production of nitric acid, glass and basalt fibres and other products for the chemical and glass industries. Applications in medicine and energy were also discussed.

The conference provided an opportunity for networking among the participants and allowed manufacturers and end users of precious metal-based materials and equipment to discuss their business needs. This interaction was also expected to promote further scientific and technical progress and ensure positive competition in these areas.

### Hydrogen Energy and Global Economy

The conference covered a range of themes from hydrogen energy to social and educational aspects of the precious metals industry. As well as issues relating directly to the pgms, the participants

discussed the wider context affecting the precious metals markets.

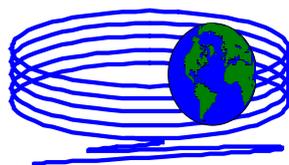
The problems of implementing hydrogen energy are closely connected with the problems of saving energy and increasing energy efficiency, topics which are of increasing importance due to growing concern over climate change. These questions were considered at the level of individual countries and regions as well as in the context of global development. The basic provisions of the 13th Report on the Development of Human Potential in Russia, “Energy and Stable Development”, formulated within the framework of the United Nations' Development Programme, were taken into account, as was the energy sector's influence on the growth of human capital and the global economy.

Innovative technologies involving the pgms which can have a

bearing on economic development were presented during the conference. One such example was a project entitled ‘Nano-Structural Catalysts for Hydrogen Energy’, presented by Professor Vladimir N. Fateev (Deputy Director, Russian Research Centre (RRC) “Kurchatov Institute”).

Educational programmes for schools and universities were a new topic for discussion at the Berlin conference. An international programme for schools on the application of resources and energy generation has been introduced, with the motto: “think globally, act locally”. Schools from seventeen countries in the Commonwealth of Independent States (CIS) and Eastern Europe participate in this programme.

Finally, the wider context of the precious metals industry was considered, following the approach taken at the third conference in this series held in Xi'an, China, in 2008, when a declaration on the ‘Development of Interregional Scientific and Educational and Humanitarian Cooperation in the



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Hi-Tech Branches of Economy' was adopted on Supermetal's initiative, and supported and updated later in Berlin. This declaration shows the potential for further growth in international cooperation between the participants of this conference series. Innovations in nanotechnology, information sharing and energy generation will contribute towards achieving a uniform process of stable development across the participating regions.

#### Foundation Award

At the Conference, the International Organisation "Professor E. I. Rytvin Foundation" awarded Professor Richard W. W. Pollock (Department of Russian Studies, Faculty of Humanities, University of Manchester, UK) a Foundation Diploma and a Memorable Silver Medal for his contributions to the development of cooperation in the field of production and application of precious metals and for organising the International Conferences "PM'2005–2010".

#### Closing Remarks

The Organising Committee of the Conference has received two offers regarding the next (fifth) international conference "Platinum Metals in Modern Industry, Hydrogen Energy and Life Maintenance of the Future", and thanks go to Keqin Yin, General Director of Wuxi International Platinum Co, Ltd, China, in 2012, and to D. Rytvin, General Director of OSWELT GmbH, Germany, and President of the "Professor E. I. Rytvin Foundation", for his invitation to hold the conference in the city of Tel Aviv, Israel. The Organising Committee will consider the offers at a correspondence meeting of the Organising Committee in December 2010.

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#### Reference

- 1 "Berlin–PM'2010. Proceedings of the Fourth International Conference 'Platinum Metals in the Modern Industry, Hydrogen Energy and the Spheres

of Life Maintenance in the Future'", Mass Media Academy (MMA), Moscow, Russia, 2010

#### List of English Abstracts

*In order of appearance*

##### Precursors for Obtaining Hydrogen Energy Electrocatalysts

T. M. Buslayeva, E. V. Volchkova, E. K. Lyutikova, V. N. Fateyev and E. S. Komandina, M. V. Lomonosov, Moscow State Academy of Fine Chemical Technology; and Institute of Hydrogen Energy and Plasma Technology of Russian Research Center "Kurchatov Institute", Moscow, Russia

The purpose of this research was to synthesise precursor complexes for obtaining hydrogen energy electrocatalysts. The composition of salts has been selected containing Co(III) in the cation composition and Pt(II) or Pt(IV) in the anion composition.

##### Precious Metals of Ural Group of Companies Ural Innovative Technologies JSC (GC Dragotsennye Metally Urala, JSC Uralskie Innovatsionnye Tekhnologii)

S. V. Nikiforov, E. V. Terentiev and A. V. Ermakov, Ural Innovative Technologies JSC, Ekaterinburg, Russia

The Precious Metals of Ural Group of Companies (PMU GC) is a rapidly developing group of Ural-based companies. Today, the group provides a wide range of services and products made of precious metals for use in different industries: vehicle manufacturing, glass, electric engineering, hydrocarbon processing, nitrogen and nitrogen compound making, jewellery, medical, etc., where platinum group metals (pgms), gold and silver are used.

##### Nanostructural Platinum Electrocatalysts for Hydrogen Energy

V. N. Fateev, Deputy Director of RRC "Kurchatov Institute", Moscow, Russia

Fuel cell systems with proton exchange membrane (PEM) compositions are usually based on catalytic pgms or their oxides. The application of new nanocatalysts and nanostructured membranes can reduce the consumption of pgms up to three times, increase specific productivity up to 50% and increase the lifetime up to two times.

##### Production of Catalyst and Catchment Systems for Ammonia Conversion According on the Umicore AG & Co KG Technology

S. V. Gakh and D. A. Savenkov, OJSC "SIC 'Supermetal'", Moscow, Russia; and Umicore AG & Co KG, Business Unit PEM, Hanau, Germany

Platinum alloy catalysts are the best ones for selective ammonia oxidation to nitric oxide. In 2008, a state-of-the-art high-tech line was launched on the platform of OJSC "SIC 'Supermetal'" in cooperation with Umicore AG & Co KG for the production of platinum alloy-based catalyst systems for ammonia oxidation in the production of nitric acid.

#### Precious Metals in the Production of Preparations for the Decoration of Ceramics and Glass

O. Galushko and A. Dokuchaev, OOO "NPK ELEFOR", Andreevka, Russia

Precious metals find application as colourants for products made of ceramic, porcelain and glass. These colourants typically contain sulforesinates, mercaptides or powders of precious metals (Au, Ag, Pd, Pt); organic compounds to improve adhesion and hardening; and organic solvents or oils to allow easy application of preparations to products.

#### Technological Aspects of Obtaining Platinum Group Metal Coatings by Metal Organic Chemical Vapour Deposition

N. V. Gelfond, I. K. Igumenov and N. B. Morozova, Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia

Metal layers were deposited by different modifications of the MOCVD technique (atmospheric pressure MOCVD, low pressure MOCVD and pulse MOCVD) using volatile metal complexes as precursors, mainly metal  $\beta$ -diketonate derivatives. Metal coatings of Pt, Ir, Pd, Ru, Rh as well as Au, Re, Ni, Cu and their composites were deposited.

#### Hydrogen-Palladium Temporary Gradient Material. Form Changes Laws and Nature of the Phenomenon

M. V. Goltsova and E. N. Lyubimenko, Donetsk National Technical University, Donetsk, Ukraine

To study mechanical hydrogen elasticity phenomena a new hydrogen-vacuum device (HVD-4) was planned and constructed. This made possible an investigation of the hydrogen elastic deformation of metals (for example palladium) at  $T > 150^\circ\text{C}$ , i.e. in the wider region of  $\alpha$ -solid solutions of hydrogen in palladium.

#### Prospects of Hydrogen Membrane Technology: Technical and Market Aspects

V. A. Goltsov, M. V. Goltsova, G. I. Zhiron, L. F. Goltsova, V. V. Vasekin and L. A. Sportsmen, Donetsk National Technical University, Donetsk, Ukraine; and Federal State Unitary Enterprise "Scientific and Industrial Complex "Supermetal" named after E. I. Rytvin", Moscow, Russia

High-purity hydrogen is essential for many hydrogen technologies. Membrane technology can be used for high-purity hydrogen production. The main characteristics of palladium alloys for hydrogen diffusion filters and the construction peculiarities of diffusion elements and hydrogen membrane apparatuses (HMA) were presented.

#### Technological Aspects for Platinum Alloy Thermocouple Wire Production at JSC Krastsvetmet

P. A. Khorikov, S. N. Mamonov, A. I. Yeskin, V. N. Yefimov and D. R. Shulgin, JSC Krastsvetmet, Krasnoyarsk, Russia

JSC Krastsvetmet is developing a new product, platinum and platinum-rhodium alloy fine wire, to be applied in thermocouples and resistance thermometers. It has been shown that the quality depends both on the usage of high-grade starting metals and improvements in alloy

production technology, resulting in a more homogeneous structure and distribution of rhodium in platinum.

#### Experience in Pyro-Processing of the Precious Metal Secondary Raw Materials at OJSC "SIC 'Supermetal'"

S. D. Levchenko and L. E. Morozova, OJSC "SIC "Supermetal", Moscow, Russia

Improvements to processing technologies for secondary raw materials and pyrometallurgic refining of precious metal alloys have been shown. Significant reduction of losses of precious metals and application of complex technologies of secondary raw material processing were demonstrated.

#### Process Excellence Model

J. Leyrer, Umicore AG & Co KG, Hanau, Germany

Umicore's business unit Platinum Engineered Materials (PEM) is one of the world's leading producers of platinum equipment for the production of high-quality glass and platinum-based catalysts for the chemical industries. This paper gives an overview of Umicore's activities in the field of platinum-based products and catalysts.

#### The High Temperature Creep Behavior of Dispersion Strengthened Pt-5Rh Composite

X. Ming, L. Ji, H. ChangYi, L. WeiPing, Z. YanMing and Z. Jiming, Kunming Institute of Precious Metals, Kunming, Yunnan, China

High-temperature tensile tests were performed on dispersion strengthened Pt-5%Rh alloy prepared by a large plastic deformation technique. High-temperature creep properties of the dispersion strengthened Pt-5%Rh alloy were found to be better than those for conventional alloy materials.

#### MOCVD Precursors of Pt Group Metals for Forming Thin Layers for Microelectronic Applications

N. B. Morozova, I. K. Igumenov and N. V. Gelfond, Nikolaev, Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia

Thin layers of pgms and gold were obtained by the MOCVD technique using volatile metal complexes with different ligands as precursors. The principles of precursor choice for obtaining thin metal films by means of MOCVD are described.

#### Effect of Electrochemical Coatings on the Corrosion of Dental Alloys

V. Parunov, I. Lebedenko, M. Stepanova and D. Belyakov, Moscow State University of Medicine and Dentistry, Moscow, Russia

In the last few years, there has been an increase in the number of investigations of the biological properties of prosthodontic materials and the interaction of these materials with living tissue. Increasing intolerance of base metal alloys means that there is a need to find an adequate substitute. Taking into account the technological complexity of titanium dentures and the insufficient

strength of ceramic crowns and dental bridges, alloys of precious metals are likely to be the best replacements for base metals.

**Members of Inter-Regional Association, Manufacturers of Industrial Products of Precious Metals, Keep Industrial Activity in the Conditions of Crisis**

O. V. Pelevin and V. Yu. Preis, Inter-Regional Association of Precious Metals Producers, PZCM-Vtormet LLC, Russia

The Inter-Regional Association of Precious Metals Producers was established in 2000 as a noncommercial partnership and includes refining plants, large plants producing high-tech industrial precious metal products, enterprises processing precious metal scrap and waste, and banks. Its members aim to maintain and develop the commercial production of precious metal goods and services in Russia without government support during the economic crisis.

**Plasma Welding Particularities and Possibilities of Platinum and Noble Metals Goods**

D. M. Pogrebisky, Jerusalem, Israel

General aspects of plasma arc welding of comparatively thin metal materials, especially platinum and other noble metal alloys, are discussed. Plasma welding of various glass melting apparatuses and devices, including those made of laminated and dispersion strengthened materials, is still not exhausted, and the technique can also be used for dental and jewellery applications.

**Properties of the Alloys of Gold with Platinoids**

V. V. Vasekin and D. S. Tykochinsky, OJSC "SIC 'Supermetal'", Moscow, Russia

The effect of platinum, palladium and other alloying elements on the properties of gold alloys has been investigated to obtain data for designing a frame material for ceramic-metal dentures. The efficiency of pgms as strengtheners of gold alloys was estimated and compared with other conventional alloying elements.

**A Novel Eptaplatin-Analogue with Improved Antitumor Efficacy**

L. Weiping, L. Liguang, C. Xizhu, Y. Qingsong and H. Shouqian, State Key Lab of Advanced Technologies for

PGMs, Kunming Institute of Precious Metals, Kunming, Yunnan, China; and Shanghai Institute of Materia Medica, Chinese Academy of Sciences, Shanghai, China

A novel water-soluble analogue of eptaplatin has been chemically synthesised and biologically evaluated in animals. It shows more activity and less toxicity than its parent drug eptaplatin, exhibiting great potential for further development.

**Platinum-Based Composites**

V. A. Yastrebov, OJSC "SIC 'Supermetal'", Moscow, Russia

One of the ways to improve the efficiency and economy of platinum and its alloys is the development and application of composite materials. Examples include ceramic products coated with platinum or its alloys and platinum-based dispersion strengthened alloys.

**Development and Production of New Jewellery 950 and 990 Palladium Based Alloys at JSC Krastsvetmet**

V. N. Yefimov, S. N. Mamonov, D. R. Shulgin and S. I. Yeltsin, JSC Krastsvetmet, Krasnoyarsk, Russia

To diversify the product range at JSC Krastsvetmet, a number of new 950 and 990 palladium jewellery alloys were made. To produce the palladium alloys induction melting in an inert atmosphere and melt pouring into a copper mould was used. The heat treatment conditions and semi-finished jewellery plastic deformation parameters were determined.

**The Ordered Phases in the Pd-Sn-Cu and Pd-Sn-Au Systems**

G. P. Zhmurko, M. A. Stepanova, E. G. Kabanova, V. N. Kuznetsov and V. V. Vasekin, Chemical Department of Moscow Lomonosov State University, Moscow, Russia; and Open Joint Stock Company Scientific and Industrial Complex "Supermetal" named after E. I. Rytvin, Moscow, Russia

Alloys of palladium containing gold form a basic system for the development of new dental alloys. The aim of the present study was to investigate the solubility of tin in the face-centred cubic solid solutions Pd-Au and Pd-Cu as well as the nature of phases coexisting with those solid solutions in the ternaries at 800°C and 500°C.