



New Application Developments in PGMs – August 2009

Improve platinum nanoparticle surface area by branching out

Noteworthy Chemistry, 03 August 2009

http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP_022659

L. Wang and Y. Yamauchi* at the National Institute for Materials Science (Ibaraki, Japan) and the Japanese Science and Technology Agency (Tokyo) have synthesized dendritic platinum nanoparticles (DPNs) with unique nanostructures and high surface areas. They developed a single-step aqueous synthetic route mediated by a Pluronic block copolymer (BCP) [PEO100PPO65PEO100, in which PEO is poly(ethylene oxide) and PPO is poly(propylene oxide)] to generate the DPNs.

Growth spurts: Berkeley Lab researchers record first real-time direct observations of nanocrystal growth in solution: Platinum

Berkeley Lab News Center, 04 August 2009

<http://newscenter.lbl.gov/feature-stories/2009/08/04/growth-spurts/>

Video: YouTube - Growth of platinum nanocrystals:

<http://www.youtube.com/watch?v=K8JulyNzS1A>

Interim Berkeley Lab Director Paul Alivisatos and Ulrich Dahmen, director of Berkeley Lab's National Center for Electron Microscopy (NCEM), led a team of experts in nanocrystal growth and electron microscopy who combined their skills to observe the dynamic growth of colloidal platinum nanocrystals in solution with subnanometer resolution.

"Our observations provide invaluable direct information on how nanocrystals grow and indicate how we might directly control nanocrystal synthesis for tailored properties," says Zheng. "Also, our in situ liquid cell TEM technique can be applied to other areas of research such as soft matter imaging and nanoparticle catalysis, and offers great potential for addressing many fundamental issues in materials science, chemistry and other fields of science."

New way to rapidly-prototype nm scale devices and materials: Platinum

Hastings Wins DARPA Career Grant

University of Kentucky News -- news.uky.edu, 04 August 2009

http://news.uky.edu/news/display_article.php?category=8&artid=4931

J. Todd Hastings, an associate professor in the University of Kentucky College of Engineering, received a DARPA Career Grant for a project that has found a new way to rapidly-prototype nanometre scale devices and materials.

The process uses electrons beamed through a liquid to deposit various materials, gold and platinum have already been demonstrated, onto a supporting object. The electron beam can be focused to a one nanometre spot, about 50,000 times smaller than a human hair, and the beam can "write" a nanoscale pattern in much the same way that one would write with ink on paper.

New clues about a hydrogen fuel catalyst: Rhodium

View of rhodium-based catalyst for hydrogen-fuel system offers ideas for improvement
EurekAlert!, 05 August 2009

http://www.eurekalert.org/pub_releases/2009-08/dnnl-nca080409.php

Scientists from the Department of Energy's Pacific Northwest National Laboratory combined experimental and theoretical studies to identify the characteristics of the catalyst, a cluster of rhodium, boron and other atoms. The catalyst chemically reacts with ammonia borane, a molecule that stores hydrogen densely, to release the hydrogen as a gas.

Hydrogen from sun and water: Platinum, palladium

Latest News | Chemical & Engineering News, 10 August 2009, Volume 87, Number 32, p. 7

<http://pubs.acs.org/cen/news/87/i32/8732notw.htm> |

Researchers at Dalian Institute of Chemical Physics, in China, have developed a three-component semiconductor-based catalyst that can produce hydrogen from water when irradiated with light in the visible-wavelength region (420 nm) with a quantum efficiency as high as 93% (J. Catal.: <http://dx.doi.org/10.1016/j.jcat.2009.06.024>).

The catalyst, prepared from cadmium sulfide doped with low concentrations of palladium sulfide and platinum, does not convert water into hydrogen and oxygen. It evolves hydrogen alone and does so only from water solutions containing sulfur-based "sacrificial" reagents that consume oxygen, according to Can Li, who led the study and directs the institute's catalysis laboratory.

New catalyst for methane to methanol: Platinum

Chemistry World, 10 August 2009

<http://www.rsc.org/chemistryworld/News/2009/August/10080902.asp>

Image: The reaction used a solid catalyst in a covalent triazine-based framework. The material possesses bipyridine units as coordination sites for platinum. It shows high activity and can be separated easily from the reaction mixture and recycled several times without significant loss of activity: http://www.rsc.org/images/meth-300_tcm18-159830.jpg

For many years people have searched for new ways to convert methane to methanol. One promising technique used a platinum-based catalyst developed by Periana and colleagues, in which platinum is coordinated to a bipyrimidine. This is then dissolved in fuming sulfuric acid - oleum - to carry out the oxidation, which involves sulfur trioxide. However, the expensive platinum proved difficult to recover from solution.

Now, a team led by Ferdi Schüth at the Max-Planck-Institut für Kohlenforschung in Mülheim have created what is in effect a solid Periana catalyst which appears to be recyclable with no loss of platinum.

Novel temperature calibration improves NIST microhotplate technology: Platinum

NIST Tech Beat, 11 August 2009

http://www.nist.gov/public_affairs/techbeat/tb2009_0811.htm#hotplate

Image: The NIST microhotplate uses its thermal efficiency in conjunction with a thermocouple to form a self-test temperature sensing system. Four microhotplates (left image) are seen with a strip of rhodium film (marked by an arrow) crossing the bottom right microhotplate. This strip makes contact with the platinum in the microhotplate structure (seen in the closeup image on the right) to form a stable thermocouple for measuring temperature: Credit: M. Afridi, NIST:

http://www.nist.gov/public_affairs/images/09EEEL09_microhotplate_temp_sensor_LR.jpg

Researchers at the National Institute of Standards and Technology (NIST) have developed a new calibration technique that will improve the reliability and stability of one of NIST's most versatile technologies, the microhotplate. The novel NIST device is being developed as the foundation for miniature yet highly accurate gas sensors that can detect chemical and biological agents, industrial leaks and ...

New way to prepare fluorinated pharmaceuticals: Palladium

Science News - redOrbit, 11 August 2009

http://www.redorbit.com/news/science/1735836/new_way_to_prepare_fluorinated_pharmaceuticals/index.html

A team of MIT chemists has devised a new way to add fluorine to a variety of compounds used in many drugs and agricultural chemicals, an advance that could offer more flexibility and potential cost-savings in designing new drugs.

In their new technique, Stephen L. Buchwald, the Camille Dreyfus Professor of Chemistry at MIT and his colleagues used a palladium catalyst to attach a fluorine atom to aromatic compounds.

Colour changing pigments detect minute hydrogen leaks: Platinum, palladium

Eureka, 13/08/2009

<http://www.eurekamagazine.co.uk/article/19486/Colour-changing-pigments-detect-minute-hydrogen-leaks.aspx>

Image: Colour changing pigments detect minute hydrogen leaks:

<http://www.eurekamagazine.co.uk/articles/19486/1.JPG>

US Scientists from the Florida Solar Energy Centre have developed a 'smart paint' that changes colour in the presence of hydrogen, allowing visible detection of minute leaks.

With many predicting a future 'hydrogen economy', simple and cheap detection of the gas will be vital. The technology could prove invaluable for use on hydrogen fuel cell powered vehicles, at hydrogen fuel stations, as well as on the infrastructure transporting the gas.

Hydrogen is an odourless and colourless substance, so a simple leak detection system could do much to reassure future developers, local authorities and users.

The technology is being applied at the Kennedy Space Centre where it is detecting leaks in the joins of pipe work (pictured). The darker area shows where the gas is escaping. The paint uses an inexpensive metal oxide based powder that can also be deposited onto tapes that adheres to pipe and flange joints.

The paint undergoes either an irreversible or reversible change. The irreversible formulations are based on titanium oxide supported palladium oxide pigments encapsulated within a silicone matrix. The reversible formulations are based on polyoxometalates of tungsten and molybdenum, doped with small amounts of platinum to catalyse the colouration bleaching reaction.

Mechanically trapped molecules throw light on energy transfer within artificial photosynthetic systems: Palladium

Riken research, 14 August 2009

<http://www.rikenresearch.riken.jp/research/759/>

A research team led by Makoto Fujita from the University of Tokyo and Tahei Tahara from the RIKEN Advanced Science Institute has found a simple way to mimic the initial stage of photosynthesis by mechanically trapping a guest molecule inside a cage structure.

Fujita and Tahara's team ensured exciplex formation by locking a photoactive donor molecule called bisanthracene inside a molecular cage acceptor (Figure 1: Schematic formation of a mechanically trapped host (H)-guest (G) exciplex complex (top) and the x-ray crystal structure of the host-guest complex (bottom): http://www.rikenresearch.riken.jp/research/759/image_2249.html). The self-assembled cage is highly water soluble as it contains six charged palladium atoms. The cage panels, however, are organic molecules and form a hydrophobic (water-repelling) pocket inside the cage when dissolved in water.

New method for fluorinating compounds : palladium

Chemistry World, 17 August 2009

<http://www.rsc.org/chemistryworld/News/2009/August/17080901.asp>

A team of chemists led by Stephen Buchwald at Massachusetts Institute of Technology in the US has developed a simple and efficient technique using a palladium(II) catalyst to attach a fluorine atom to aromatic compounds. A triflate leaving group, which is attached to the aromatic compound, is removed by the palladium catalyst, and is replaced with a fluorine atom taken from a simple fluoride salt.

This discovery could impact the design and production of new drugs and agricultural chemicals, and improve scanning techniques such as PET (positron emission tomography).

TR35 2009: Young Innovators Under 35: Assembling nanocrystals to create made-to-order materials: Platinum, palladium

Elena Shevchenko, 32, Argonne National Laboratory

TR35 2009 | Technology Review, August 2009

<http://www.technologyreview.com/TR35/Profile.aspx?TRID=828>

Image: Creating order: Top left: a crystal made from cobalt-platinum nanoparticles. Clockwise from top right: "superlattices" combining nanoparticles of lead selenide and gold, cadmium selenide and gold, and lead selenide and palladium: <http://www.technologyreview.com/files/32411/0909-Shevchenko.jpg>

Elena Shevchenko is a master at making nanoparticles and assembling them into precise structures with useful properties. Materials made from the nanocrystals created with her methods could lead to ultra-efficient solar cells, tiny but powerful magnets, super-dense hard disks, and faster computers.

Trained as a chemist in Belarus, the University of Hamburg in Germany, and Columbia University in New York, Shevchenko has found better ways to make nanoparticles out of metallic compounds; she's produced lead telluride, cadmium selenide, and cobalt-platinum particles, among others. She has also developed a technique for assembling these nanoparticles into "superlattices," orderly crystal structures.

Paul Alivisatos, a nanotech pioneer and interim director of the Lawrence Berkeley National Laboratory, calls Shevchenko "the best grower of nanocrystals in the world today."

Mixing and matching these nanoscale building blocks offers endless possibilities for engineering structures with desired optical, electrical, and magnetic properties. A nanoparticle array of lead telluride and silver telluride, for example, is 100 times as conductive as arrays made of either particle alone. So far, Shevchenko has created dozens of new materials

TR35 2009: Young Innovators Under 35: Micropumps deliver drugs that prevent blindness: Platinum

Ellis Meng, 34, University of Southern California
TR35 2009 | Technology Review, August 2009

<http://www.technologyreview.com/TR35/Profile.aspx?TRID=824>

Image: Prescription pump: Ellis Meng's implantable device for delivering drugs to the eye consists of a chamber that stores the medication; a pump; and a tiny tube that enters the eye. Within the pump, wirelessly powered platinum electrodes produce a current that splits water into hydrogen and oxygen gas, inflating a miniature bellows to force medication out of the reservoir, through the tube, and into the eye:

http://www.technologyreview.com/files/32412/0909-meng_LabId_x600.jpg

1. Implantable drug pump
2. Delivery tube
3. Refill port
4. Drug reservoir
5. Polymer bellows
6. Pump base and electrodes

Treating many of the diseases that cause blindness involves frequent, painful injections directly into the eyes, putting patients at risk for infection, cataracts, and torn retinas. Ellis Meng, an assistant professor of biomedical and electrical engineering, has built an implantable pump to deliver medications more safely.

About the size of a watch battery, her device uses a microfluidic pump to push medications from a reservoir through a small tube and into the eye. A surgeon implants the pump and reservoir on the outer surface of the eye; only the tube enters the eye itself. And unlike existing implants that must be replaced periodically as they run out of drugs, Meng's is refillable. Instead of weekly injections or monthly surgeries, a patient could take just one trip to the operating room, dramatically reducing both pain and risk. Meng is still testing the eye pump in animals but hopes it can be tested in humans within five years.

Berkeley Lab's advanced light source receives \$11.3 million to enable new types of scientific inquiry: Platinum

Berkeley Lab News Center, 19 August 2009

<http://newscenter.lbl.gov/press-releases/2009/08/19/als-arra-funding/>

Scientists using the powerful beam lines at Berkeley Lab's Advanced Light Source in recent years have conducted breakthrough research on platinum-nickel alloys as a catalyst for fuel cells, made a discovery about the Ebola virus structure that could lead to a vaccine, and crafted a new technique for guiding self-assembly of nanostructures that should open up vistas for entirely new applications.

NZ researcher's precious metal breakthrough offers cleaner air: Palladium

3 News > National > Story, 27 August 2009

<http://www.3news.co.nz/NZ-researchers-precious-metal-breakthrough-offers-cleaner-air/tabid/423/articleID/118608/cat/64/Default.aspx>

Wellington University student John Watt was named the 2009 MacDiarmid Young Scientist of the Year.

By manipulating the size and shape of palladium nanoparticles -- the first time anyone has been able to fully track the growth of palladium nanoparticles and learn how to change their normal structure -- Mr Watt has made it cost-effective to use the expensive metal.

"We grow the nanoparticles in solution which makes them easier to extract and results in less waste," he said.

Platinum nanocatalyst could aid drugmakers

Rice University | News & Media, 31 August 2009

<http://www.media.rice.edu/media/NewsBot.asp?MODE=VIEW&ID=12989&SnID=154992879>

Rice chemists design polymer-coated nanorods for industrial use

Rice University chemists Eugene Zubarev and Bishnu Khanal have shown that a polycrystalline shell of platinum can be deposited on single-crystalline gold rods. The surfaces of these structures can be covalently functionalized with organic molecules to form Au/Pt/polystyrene nanorods which are soluble in organic solvents.

"The selectivity of the coated gold and platinum nanorods will be very attractive to industry," Zubarev said. "For example, we found they had nearly 100 percent catalytic selectivity for the hydrogenation of terminal olefins."

New on-purpose route to 1-octene is under development: Palladium, ruthenium

Patent Watch, 31 August 2009

http://portal.acs.org/portal/PublicWebSite/patent/archive/CNBP_022823

D. Delledonne and F. Rivetti of Polimeri Europa, <http://www.polimerieuropa.com/>, disclose an on-purpose route to 1-octene based on the hydrodimerization of butadiene followed by selective hydrogenation of the intermediate 1,7-octadiene. The hydrodimerization is carried out with a homogeneous palladium-based catalyst in aprotic solvents, especially disubstituted cyclic ureas, in the presence of a hydrogen donor such as formic acid. The selective hydrogenation reaction uses a nonsupported ruthenium complex as catalyst.

Produce hydrogen from hydrazine hydrate: Rhodium

Noteworthy Chemistry, 31 August 2009

http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP_022822

S. K. Singh, X.-B. Zhang, and Q. Xu at the National Institute of Advanced Industrial Science and Technology (Osaka, Japan) used safer and readily available hydrazine hydrate (H₂NNH₂·H₂O, 7.9 wt% H₂ equivalent) as a hydrogen source and rhodium nanoparticles (RhNPs) as active, selective catalysts for hydrogen generation. The NPs were prepared by reducing aqueous Rh(NO₃)₃ with NaBH₄.

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