



## New Application Developments in PGMs – July 2009

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### **Catalysing the fuels of the future: Platinum**

Chemistry World, 02 July 2009

<http://www.rsc.org/chemistryworld/News/2009/July/02070901.asp>

US biofuel producer Virent Energy Systems, <http://www.virent.com/>, has been awarded the US Environmental Protection Agency (EPA)'s Presidential Green Chemistry Challenge Small Business Award for its development of a cost-effective and energy-efficient method of turning plant sugars into hydrocarbon fuels.

The process uses a catalyst similar to those used in the petrochemical industry and contains precious metals like platinum. According to Randy Cortright, co-founder and chief technical officer of Virent, the catalyst works at low temperature and is formulated in such a way as to survive working in aqueous conditions.

Virent Energy Systems, Inc.: BioForming® Process: Catalytic Conversion of Plant Sugars into Liquid Hydrocarbon Fuels

2009 Small Business Award | Green Chemistry | US EPA

<http://www.epa.gov/greenchemistry/pubs/pgcc/winners/sba09.html>

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### **Tag and modify proteins: Ruthenium**

Chemical Science, 02 July 2009

[http://www.rsc.org/Publishing/ChemScience/Volume/2009/08/tag\\_modify\\_proteins.asp](http://www.rsc.org/Publishing/ChemScience/Volume/2009/08/tag_modify_proteins.asp)

Ben Davis at the University of Oxford and his team tagged a protein with an amino acid to make a structure that can be transformed into new proteins in a Nobel Prize-winning reaction called olefin cross metathesis.

Enabling olefin metathesis on proteins: chemical methods for installation of S-allyl cysteine

Chem. Commun., 2009

<http://dx.doi.org/10.1039/b908004j>

Hoveyda-Grubbs second generation ruthenium catalyst

Image: <http://www.rsc.org/ej/CC/2009/b908004j/b908004j-s1.gif>

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### **Improved incandescent performance: Iridium**

NYTimes.com, 05 July, 2009

<http://www.nytimes.com/2009/07/06/business/energy-environment/06bulbs.html?pagewanted=2&ref=business>

A physics professor at Rensselaer Polytechnic Institute, Shawn-Yu Lin, is seeing improved incandescent performance by using a high-tech, iridium-coated filament that recycles wasted heat. "The technology can get up to six to seven times more efficient," Mr. Lin said.

Shawn-Yu Lin, RPI Center for Future Energy Systems,

[http://www.rpi.edu/cfes/abt\\_r\\_lin.html](http://www.rpi.edu/cfes/abt_r_lin.html)

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### **Run a ring-closing metathesis reaction in a supercritical fluid: Ruthenium**

Patent Watch, 06 July, 2009

[http://portal.acs.org/portal/PublicWebSite/patent/archive/WPCP\\_012335](http://portal.acs.org/portal/PublicWebSite/patent/archive/WPCP_012335)

Image:

[http://portal.acs.org/portal/binfetch/consumption?fileUrl=/stellent/groups/web/documents/article/%7Eexport/WPCP\\_012335%7E5%7EHTML\\_DC\\_TEMPLATE%7ESNIPPET\\_LAYOUT/11995-1.jpg](http://portal.acs.org/portal/binfetch/consumption?fileUrl=/stellent/groups/web/documents/article/%7Eexport/WPCP_012335%7E5%7EHTML_DC_TEMPLATE%7ESNIPPET_LAYOUT/11995-1.jpg)

Method for carrying out continuous catalytic olefin ring-closing metathesis in compressed carbon dioxide in a two-phase system using ionic liquids

CAS Patent Watch, March 23, 2009

<http://www.cas.org/pwatch/032309.html>

Boehringer Ingelheim International G.m.b.H., Germany  
Boehringer Ingelheim Pharma G.m.b.H. & Co. K.-G.  
Studiengesellschaft Kohle M.b.h.

A method for carrying out continuous olefin (e.g., the conversion of 1,7-octadiene into cyclohexene and ethylene) ring-closing metathesis is described where compressed carbon dioxide (gaseous, liq., or supercrit.) is used as a solvent for the liq. or solid reactant and the products produced. One or more ionic liqs. are addnl. introduced as the second phase in which the homogeneous Ru-complex olefin metathesis catalysts are immobilized; a process flow diagram is presented.

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### **Here's an efficient biomimetic synthesis of (+)-davanone: Palladium**

Noteworthy Chemistry, 06 July, 2009

[http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP\\_022178](http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP_022178)

Image:

[http://portal.acs.org/portal/binfetch/consumption?fileUrl=/stellent/groups/web/documents/article/%7Eexport/CNBP\\_022178%7E2%7EHTML\\_DC\\_TEMPLATE%7ESNIPPET\\_LAYOUT/11266-2.jpg](http://portal.acs.org/portal/binfetch/consumption?fileUrl=/stellent/groups/web/documents/article/%7Eexport/CNBP_022178%7E2%7EHTML_DC_TEMPLATE%7ESNIPPET_LAYOUT/11266-2.jpg)

D. A. Vosburg and co-workers at Harvey Mudd College (Claremont, CA) developed a much shorter process guided by the biosynthesis of 1.

An unusual intramolecular cyclization of 4 with a palladium catalyst and a bisphosphine ligand is used to make cis-furan ester 5.

Pd2dba3 with (S)-C3-TunePhos

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### **Use air-stable boronates for Suzuki coupling: Palladium**

Noteworthy Chemistry, 06 July, 2009

[http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP\\_022178](http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP_022178)

Image:

[http://portal.acs.org/portal/binfetch/consumption?fileUrl=/stellent/groups/web/documents/article/%7Eexpo rt/CNBP\\_022178%7E2%7EHTML\\_DC\\_TEMPLATE%7ESNIPPET\\_LAYOUT/11266-1.jpg](http://portal.acs.org/portal/binfetch/consumption?fileUrl=/stellent/groups/web/documents/article/%7Eexpo rt/CNBP_022178%7E2%7EHTML_DC_TEMPLATE%7ESNIPPET_LAYOUT/11266-1.jpg)

The Suzuki coupling is a valuable synthetic transformation that requires boronic acids. Some boronic acids, however, are prone to degradation in storage or under reaction conditions.

D. M. Knapp, E. P. Gillis, and M. D. Burke at the University of Illinois at Urbana-Champaign report a solution to this problem that uses N-methyliminodiacetic acid (MIDA) boronates (1). These compounds are air-stable indefinitely, are soluble in most organic solvents, and can release the corresponding boronic acid in situ (see figure).

Pd(OAc)<sub>2</sub>, SPhos  
Pd<sub>2</sub>(dba)<sub>3</sub>, XPhos

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### **Room-temperature hydrogen generation from hydrous hydrazine for chemical hydrogen storage: Rhodium**

J. Am. Chem. Soc., 07 July, 2009

<http://pubs.acs.org/doi/full/10.1021/ja903869y>

Researchers from the National Institute of Advanced Industrial Science and Technology (AIST), Japan, have found that rhodium (Rh) nanoparticles (NPs) effectively catalyze the decomposition of hydrous hydrazine to produce hydrogen under ambient reaction conditions. Rh(0) NPs with a particle size of 5 nm prepared in the presence of hexadecyltrimethyl ammonium bromide show higher catalytic activity.

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### **The s-factor: enhancing breast dosimetry: Rhodium**

MedicalPhysicsWeb, 08 Jul, 2009

<http://medicalphysicsweb.org/cws/article/research/39780>

To determine whether the equivalent PMMA thicknesses calculated in their previous work hold true for today's wider range of targets, filters and tube voltages, the researchers recalculated the values for Mo/Mo, Mo/Rh, Rh/Rh and W/Rh at tube voltages between 25 and 35 kV. They also determined the equivalent thicknesses for W/Al spectra from 25 to 40 kV.

To calculate the s-factors, the researchers ran the Monte Carlo programme for a wide range of breast thicknesses, breast glandularities and X-ray spectra. They first recalculated the s-factors for spectra from Mo/Mo, Mo/Rh, Rh/Rh and W/Rh target/filter combinations, using a voltage range of 25-35 kV (greater than employed previously). The resulting values agreed with those used in current standards to within a few percent. The authors note that, for practical reasons, the s-factors used in existing breast dosimetry protocols should not be changed.

The new s-factors have been introduced for dosimetry in the UK's NHS Breast Screening Programme (NHS BSP Equipment Report 0604 Version 3).

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**Facile synthesis of nanoparticles with multiplefunctions advanced in Singapore: PGMs**  
EurekaAlert!, 13-Jul-2009

[http://www.eurekaalert.org/pub\\_releases/2009-07/afst-fso071309.php](http://www.eurekaalert.org/pub_releases/2009-07/afst-fso071309.php)

Metals that dissolve in water successfully extracted, transferred into layer of organic solvent that floats on water.

Singapore's Institute for Bioengineering and Nanotechnology (IBN) has discovered a new environmentally friendly method to synthesize a wide variety of nanoparticles inexpensively. This new chemical synthesis has been recently published in Nature Materials.

IBN researchers have developed a protocol to transfer metal ions from an aqueous solution to an organic solution such as toluene.

A general phase-transfer protocol for metal ions and its application in nanocrystal synthesis

Supplementary information | Nature Materials, 13 July 2009

<http://www.nature.com/nmat/journal/vaop/ncurrent/extref/nmat2490-s1.pdf>

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**Make seven- and eight-membered enantioselectiveheterocycles by using olefin hydroacylation: Rhodium**

Noteworthy Chemistry, July 13, 2009

[http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP\\_022281](http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP_022281)

Rhodium-catalyzed hydroacylation is a useful route to medium-size cyclic ketones, but larger enantioselective heterocycles have not been prepared efficiently. M. M. Coulter, P. K. Dornan, and V. M. Dong at the University of Toronto believed that products with larger rings could be created by using intramolecular enantioselective rhodium-catalyzed hydroacylation of alkenals that contain ether or thioether linkages.

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**Catalysts for the high-selectivity telomerization of butadiene have been developed: Palladium**

Patent Watch, 20 July, 2009

[http://portal.acs.org/portal/PublicWebSite/patent/archive/CNBP\\_022287](http://portal.acs.org/portal/PublicWebSite/patent/archive/CNBP_022287)

D. Roettger and colleagues at Oxeno Olefinchemie found that group 8-10 metals combined with carbene ligands give high telomerization activity and selectivity.

Catalyst system, e.g. Pd(acac)<sub>2</sub> and 5-methoxy-1,3,4-triphenyl-4,5-dihydro-1H-1,2,4-triazoline (from which a carbene can be formed by eliminating MeOH)

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**Fuel cell catalysts go sub-nano: Platinum**

Chemistry World, 20 July 2009

<http://www.rsc.org/chemistryworld/News/2009/July/20070902.asp>

"Japanese researchers have created sub-nano scale platinum clusters with high catalytic activity for use in fuel cell applications. The tiny catalyst particles - the smallest of which contain just 12 atoms in total - could help to conserve the planet's limited supply of platinum."

Size-specific catalytic activity of platinum clusters enhances oxygen reduction reactions

Nature Chemistry, 20 July 2009

<http://dx.doi.org/10.1038/NCHEM.288>

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### **Solar energy in Israel: Ruthenium**

Solar energy in Israel: It's a knockout  
The Economist print edition, 23 July 2009

[http://www.economist.com/sciencetechnology/displaystory.cfm?story\\_id=14082027](http://www.economist.com/sciencetechnology/displaystory.cfm?story_id=14082027)

Jonathan Goldstein of 3GSolar, <http://3gsolar.com/>, hopes to get rid of silicon altogether. 3G's "dye-sensitised" solar cells use titanium dioxide (more familiar as a pigment used in white paints) and complicated dye molecules that contain a metal called ruthenium. When one of the dye molecules is hit by light of sufficient energy, an electron is knocked out of it and absorbed by the titanium dioxide, before being passed out of the cell to do useful work.

This is a well-known process (it was invented 20 years ago by Michael Grätzel, a physicist at the Federal Polytechnic School in Lausanne, Switzerland) and several firms are trying to commercialise it. Dr Goldstein, however, thinks 3G has an edge over its rivals because of the way it draws off the power—though he is reluctant to go into details. One thing that is clear, though, is that dye-sensitised cells will be cheap to make. Both silicon cells and a third technology, so-called thin-film cells (which use novel materials such as cadmium telluride deposited onto sheets of glass or steel), have to be made in a vacuum. That is expensive. Dye-sensitised cells can be made by a process similar to screen printing, which is cheap.

Dye-sensitised cells are not as efficient as silicon ones, but their cheapness may outweigh that in many applications. As Barry Breen, 3G's boss, points out, more than a billion and a half people have no access to grid electricity. ...

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### **Rolling out the nanotubes: Synthesis of graphitic nanotubes containing platinum metals achieved through self-assembly techniques**

Riken research, 24 July 2009

<http://www.rikenresearch.riken.jp/research/753/>

Takuzo Aida and Takanori Fukushima of the RIKEN Advanced Science Institute in Wako and colleagues from the Japan Science and Technology Agency have developed a way to controllably self-assemble graphitic molecules and platinum metals into nanotubes with specific dimensions and structural features.

"Our nanotube can serve as a unique one-dimensional nano-scaffold with not only high structural integrity, but also with beneficial electronic properties such as energy and charge transport capabilities," says Fukushima. "We expect that the combination of these two components might lead to unprecedented phenomenon and functions."

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### **New supercomputer to reel in answers to some of earth's problems: Green plastics: Platinum**

PNNL: Newsroom, 27 July 2009

<http://www.pnl.gov/news/release.asp?id=387>

The \$21.4 million Chinook supercomputer was built by HP, tested by a variety of researchers, and has now been commissioned for use by Pacific Northwest National Laboratory and the Department of Energy.

Green plastics: Industrial chemists can turn propane gas into plastics and generate only water as a byproduct with the help of compounds called catalysts. Chinook is helping scientists develop a new catalytic material based on small clusters of platinum atoms that does this at least 40 times more efficiently than older materials.

**Control the loading of ultrafine noble metal particles on titania: Platinum, ruthenium**  
Noteworthy Chemistry, 27 July 2009

[http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP\\_022577](http://portal.acs.org/portal/PublicWebSite/noteworthy/archive/CNBP_022577)

Z. Liu and co-workers at the Chinese Academy of Sciences (Beijing) describe a simple yet effective in situ method for depositing noble metal particles on TiO<sub>2</sub>. They hydrolyzed TiCl<sub>3</sub> to form Ti(III) oxide, then injected a metal precursor to obtain <2.5-nm noble metal nanoparticles supported on TiO<sub>2</sub>.

Samples prepared by using the authors' method show improved photocatalytic activity for degrading phenol. The best example is a Pt/TiO<sub>2</sub> catalyst with 2.44 wt% loading of 0.5-nm platinum particles. The authors attribute the enhancement of photocatalytic activity to strong synergy between the platinum particles and the TiO<sub>2</sub> support.

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**8 Legs or 8 Faces?: Palladium**

Editors' Choice: Highlights of the recent literature, SCIENCE, 31 July 2009, Volume 325, Issue 5940

<http://www.sciencemag.org/content/vol325/issue5940/twil.dtl>

Octopi are so named because these intriguing sea creatures have eight legs. Lu et al. have prepared an "octapi" supramolecular complex, so named because it assembles through the stacking interactions of eight faces—more specifically, the faces of aromatic rings bearing delocalized pi-bonded electrons. The authors mixed palladium ions in solution with phenyl-substituted phosphine ligands and pyridine-substituted pyrazole ligands. When the latter ligands were properly sized (with a two-carbon bridge linking a pair of pyridylpyrazoles), crystals formed in which, at the molecular scale, two tightly interlocked macrocycles were held together by a 2.5-nm-long column of stacking interactions involving eight phenyl and pyridyl faces, supplementing phosphorus and pyridyl-nitrogen coordination to the metal centers. Extending the pyrazole bridge length by one carbon disrupted the geometric balance, leading to separated (rather than linked) macrocycles in the resultant crystal lattice.

Octapi Interactions: Self-Assembly of a Pd-Based [2]Catenane Driven by Eightfold  $\pi$  Interactions

J. Am. Chem. Soc., 2009, 131, (30), pp 10372-10373

<http://dx.doi.org/10.1021/ja9041912>

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