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Catalysis Club of Philadelphia

Thursday, November 15, 2007

Sheraton Bucks County Hotel

400 Oxford Valley Road

Langhorne, PA 19047

Joint meeting with the Catalysis Society of Metropolitan New York

Selective oxidation using supported gold and gold palladium nanoparticles

Prof. Graham Hutchings

Cardiff University, UK

Social Hour: 6:00 PM

Dinner: 7:00 PM

Meeting: 7:45 PM

Members: \$30.00

Walk Ins & Non-members: \$35.00

Student & Retired Members:

\$15.00

Menu

Dinner Buffet:

Sliced Sirloin of Beef

Chicken Hunter

Stuffed Shells Marinara

Meeting registration – Please notify your company representative or Carl Menning (menning@udel.edu, phone: 302-893-9398, fax: 302-831-1048) by **Thursday, November 8.**

No meal reservation is required for this meeting, since the dinner is buffet-style.

Company Representatives – We would like to encourage you to make meeting registrations with your company representative.

Membership – Dues for the 2007-08 season will be \$10.00 (\$5.00 for the local chapter and \$5.00 for the national club). Dues for students and post-docs will be \$6.00 (\$5.00 for local club and \$1.00 for national club). Please send your payment to Steve Harris, Lyondell Chemical Co., 3801 West Chester Pike, Newtown Square, PA 19073-2387.

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Selective oxidation using supported gold and gold palladium nanoparticles

Prof. Graham Hutchings

Cardiff University, UK

Abstract

Heterogeneous catalysis plays a major role in everyday life, not only with respect to an economic viewpoint, but it also provides the necessary infrastructure for the well being of society as a whole. Without effective heterogeneous catalysis the manufacture of many materials, pharmaceuticals and foodstuffs would not be possible. Against this background, it is important to note that selective oxidation remains one of the key synthetic steps for the activation of a broad range of substrates for the production of either finished products or intermediates for the preparation of pharmaceuticals, agrochemicals, as well as commodity chemicals. However, given its central importance, it is surprising that there have been only a few notable new approaches in the design of selective oxidation catalysts in the past forty years.

A key discovery in the last two decades has been the identification that gold, when prepared as supported nanoparticles, is exceptionally effective as an oxidation catalyst. To some extent this observation is counter intuitive since extended gold surfaces do not chemisorb oxygen, nor do they corrode. Gold is known as an immutable material, much prized for its beauty and value, which, for many years, has diverted attention from its intrinsic high reactivity. Following this discovery, there has been an explosion of interest in gold as a catalyst and several hundred papers and tens of patents are being published annually, although much of this concerns the relatively simple oxidation of CO. Gold catalysis is now a major topic for both heterogeneous and homogeneous catalysis worldwide. This presentation will explore the latest developments using supported gold and gold palladium nanoparticles the formation of hydrogen peroxide and the selective oxidation of alcohols. This will include recent studies on the direct synthesis of hydrogen peroxide, the epoxidation of alkenes and the selective oxidation of alcohols.

References

1. Mathew D. Hughes, Yi-Jun Xu, Patrick Jenkins, Paul McMorn, Philip Landon, Dan I. Enache, Albert F. Carley, Gary A. Attard, Graham J. Hutchings, Frank King, E. Hugh Stitt, Peter Johnston, Ken Griffin and Christopher J. Kiely, [Tunable gold catalysts for selective hydrocarbon oxidation under mild conditions](#), Nature 437 (2005) 1132, doi:10.1038/nature04190
2. Enache, Dan I.; Edwards, Jennifer K.; Landon, Philip; Solsona-Espriu, Benjamin; Carley, Albert F.; Herzog, Andrew A.; Watanabe, Masashi; Kiely, Christopher J.; Knight, David W.; Hutchings, Graham J., [Solvent-Free Oxidation of Primary Alcohols to Aldehydes Using Au-Pd/TiO₂ Catalysts](#), Science 311 (2006) 362, doi:10.1126/science.1120560

Speaker's Biography



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Additional Information

PhD University College London (1975, C. A. Vernon, Biological Chemistry). Scientific Officer, ICI Petrochemicals (1975-79) Research and Production Manager, ICI Petrochemicals (1979-1981) and Chief Scientific Officer AE&CI, Modderfontein South Africa (1981-84). Lecturer, Senior Lecturer and Professor, Department of Chemistry, University of Witwatersrand (1984-7). Assistant Director, Leverhulme Centre for Innovative Catalysis, University of Liverpool (1984-94). Professor and Deputy Director, Leverhulme Centre (1994-7). Appointed Head of Department and Professor of Physical Chemistry, Cardiff, in 1997. DSc, University College London (2002).

Langmuir Distinguished Lecturer Award, Division of Colloid and Surface Science, ACS, 1996, Member of the Fachbeirat of the Fritz-Haber-Institut, Berlin, 1999-2011. DGMK 2001 - Kolleg Lectureship, Germany, 2001. IChemE Entech Medal 2004. RSC 2004 Award for Heterogeneous Catalysis. IChemE iAc 2005 Award for Applied Catalysis. EFCATS 2006 François Gault Lecturer. Invited Professor in Residence at the Université Pierre et Marie Curie, Paris, 2003-4, 2006-7. Visiting Professor, University of Witwatersrand since 2000.

Research Interests

- The study of gold nanocrystals as novel active heterogeneous catalysts and their characterisation under reaction conditions.
- The design of selective oxidation and hydrogenation catalysts and their study using in situ spectroscopy.
- The design of enantioselective heterogeneous catalysts, in particular using chirally modified zeolite catalysts