

Highly Active Platinum Phosphinito Homogeneous Catalyst

The hydration of nitriles is a classic reaction in organic chemistry. There are various ways in which nitriles can be activated, but none are as efficient as using a catalyst that combines the advantages of platinum (Pt) ion activation with intramolecular attack. Phosphinito complexes of platinum, in particular [PtH(PMe₂OH)(PMe₂O)₂H], **1**, are known as being highly active and versatile for nitrile hydrations (1–3). **1** can catalyse the hydration of acrylonitrile to acrylamide with a turnover number of 77,000 and no tendency of further hydrolysis to the acid. **1** aids preparations of simple amides, not readily prepared by other routes, and of β -blocker, Atenolol.

Now scientists at Harvard University, U.S.A., report that **1** can transform the nitrile group of an

epimerised product into the corresponding primary amide (**4**). In the synthesis of Stephacidin B, **1** was indispensable in a step where a nitrile group of a Strecker-like HCN addition product became a primary amide under neutral conditions. The authors suggest this transformation has scope in the hydrolyses of other Strecker-derived addition products.

References

- 1 A. W. Parkins, *Platinum Metals Rev.*, 1996, **40**, (4), 169
- 2 T. Ghaffar and A. W. Parkins, *J. Mol. Catal. A: Chem.*, 2000, **160**, (2), 249
- 3 X.-B. Jiang, A. J. Minnaard, B. L. Feringa and J. G. de Vries, *J. Org. Chem.*, 2004, **69**, (7), 2327
- 4 S. B. Herzon and A. G. Myers, *J. Am. Chem. Soc.*, 2005, **127**, (15), 5342

Preparation of Nanoparticles with Narrow Size Distribution

In 'structure sensitive' catalytic reactions there is an ideal size and morphology for the metal particles on the catalyst surface for optimum reaction conditions. If a 'monomodal distribution' could be produced, the less effective particles could be excluded and the metal used more efficiently. A narrow particle size distribution gives them a very high surface area, better for catalytic activity and good order (1). Work has been done on chemical routes to achieve this; for instance, IBM has patents describing narrow size distributions in nanoparticles produced by decomposition of metal salts and complexes (2).

In the latest literature, workers in Singapore and Zhejiang, China, have produced uniform platinum (Pt) nanoparticles of average diameter \sim 3 nm and good dispersion on carbon nanotubes by a microwave-heating polyol process. The nanoparticles have a sharp size distribution with high dispersion on the C nanotubes surface. Higher catalytic activity for methanol electrooxidation at room temperature than a commercial platinum catalyst was demonstrated (3).

Workers in Lanzhou, China, have produced highly-ordered well-dispersed Pt colloidal nanoparticles by reducing H₂PtCl₆ with hydrogen using PVP as a stabilising agent. When used as Pt/glassy carbon electrodes, for absorbed CO oxidation, with particle size $<$ 1 nm, the particles demonstrated high activity (4).

In Japan (5), workers found that Pt clusters (1–3 nm) embedded in C particles diffused through the covered amorphous C layer on heating above 1200°C.

The clusters were three times more stable at high temperatures than commercial Pt clusters on carbon.

In China, monodisperse palladium (Pd) nanoparticles (6) of size $<$ 5 nm with a 10% size distribution were produced with a hypophosphite reducing agent. The Pd nanoparticles formed a well-ordered 2D array. Other reducing agents gave no observable size change, but wide size distribution. Different capping agents altered stability, self-organised patterns, and solubility.

Workers in Italy, found novel Pt-Ru nanoparticles on C substrates could be reproducibly prepared using metal-organic precursors under vacuum at low temperatures. The nanoparticles were homogeneously dispersed, had narrow size distribution (\sim 2 nm) and were efficient at methanol electrooxidation (7).

References

- 1 B. Thiébaud, *Platinum Metals Rev.*, 2004, **48**, (2), 62
- 2 IBM, *European Appl.* 977,212; 2000; IBM, *U.S. Appl.* 2003/0,121,364; 2003
- 3 W. Chen, J. Zhao, J. Y. Lee and Z. Liu, *Mater. Chem. Phys.*, 2005, **91**, (1), 124
- 4 Z. Tang, D. Geng and G. Lu, *J. Colloid Interface Sci.*, 2005, **287**, (1), 159
- 5 H. Suzuki, M. Shintaku, T. Sato, M. Tamano, T. Matsuura, M. Hori and C. Kaito, *Jpn. J. Appl. Phys., Part 2*, 2005, **44**, (19), L610
- 6 M. Chen, J. Falkner, W.-H. Guo, J.-Y. Zhang, C. Sayes and V. L. Colvin, *J. Colloid Interface Sci.*, 2005, **287**, (1), 146
- 7 P. Sivakumar, R. Ishak and V. Tricoli, *Electrochim. Acta*, 2005, **50**, (16–17), 3312