potential user's site in container drums. The results from the trial, which should last for at least 1000 hours of continuous operation, will allow the viability of the process to be proven at small cost, before a full size plant is commissioned.

Where a trial is successful and when the operating variables are established, including, for example, the regularity of water rinsing necessary to prevent the build up of ammonium salts during the methanol drying technique, then fast economic pay-back times can be anticipated and a remarkably cheap hydrogen source deployed. J.E.P.

References

1 J. E. Philpott, *Platinum Metals Rev.*, 1976, **20**, (4), 110; and references therein

2 M. J. C(ole), *Platinum Metals Rev.*, 1981, **25**, (1), 12

3 J. E. Philpott, *Platinum Metals Rev.*, 1985, **29**, (1), 12; and references therein

Improved Catalyst System for the Wacker Process

The Wacker process for the palladium catalysed conversion of ethylene to acetaldehyde is one of the oldest industrial homogeneous catalyst systems. The original process was plagued by problems of corrosion within the reactor system, and has been replaced by a heterogeneous catalyst system which suffers, however, from the problem of poor catalyst utilisation.

Acetaldehyde used to be a major source of acetic acid and while this route has largely been superseded by rhodium catalysed carbonylation, the Wacker process remains a major route to acetaldehyde. The problems outlined above that are associated with the Wacker catalyst have been, to a large extent, circumvented by a new catalyst system developed by workers in the Department of Chemical and Materials Engineering at the University of Iowa (V. Rao and R. Datta, *J. Catal.*, 1988, **114**, (2), 377–387).

The supported liquid melt catalyst which they have used consists of a spherical silica support which contains a palladium chloride-copper(II) chloride catalyst in a eutectic melt of copper(I) chloride-potassium chloride. The location of the homogeneous catalyst within the pores of the support avoids the problems both of corrosion of the plant and also product/catalyst separation, which are associated with the conventional homogeneous system. However, the system remains in essence a soluble catalyst and retains the benefits of the rates and conversions achieved with the homogeneous catalyst. It shows a better utilisation of metal than the conventional supported liquid phase catalysts. In addition the use of a melt media avoids the rapid deactivation associated with supported liquid phase catalysis containing aqueous catalyst solutions. The use of a copper(I) chloride-potassium chloride with a melting point of 423K means that the complete oxidation of ethylene to carbon dioxide and water is avoided.

The authors have combined a number of concepts which have been available for some time, and appear to have developed a system which avoids most of the pitfalls associated with other catalyst systems for the Wacker process. If it can be established that the catalyst maintains its activities for substantially greater than one week, does not cause corrosion, and if catalyst attrition is not a problem, then the system may have considerable commercial significance. However, the relative simplicity and high stability of the catalyst components in the Wacker catalyst system may mean that it is difficult to apply this technology in a more general fashion. M.J.H.R.

Hydrogen Storage Material

Although iron-titanium is an excellent material for hydrogen storage, it becomes deactivated after repeated charge-discharge cycles. The mechanism of this phenomenon has been determined by J. H. Sanders and B. J. Tatarchuk of Auburn University, Alabama, U.S.A., who have also investigated the use of thin palladium films to protect the alloy from deactivation (*Thin Solid Films*, 1988, **166**, 225–233; *J. Phys. F: Met, Phys.*, 1988, **18**, (11), L267–L270).

Deactivation is triggered by oxygen impurities in the hydrogen charging gas reacting with titanium in the surface layer of the iron-titanium matrix, forming titania and metallic iron crystallites which are inert to reversible hydrogen storage. However under the conditions of interest a thin 5nm layer of palladium provides an effective barrier to oxygen, preventing deactivation and so increasing the useful life of the alloy. The integrity of the coating has been verified by conversion electron Mössbauer spectroscopy.