inactive carbon monoxide present on the surface during hydrogenation.

The hydrogenolysis of ethane to methane was the one structure sensitive reaction studied and again there were differences between the cluster catalysts and conventional catalysts. For this reaction the activation energies were lower and the activities significantly higher than conventional osmium catalyst, see Figure 6. This was the first indication that cluster catalysts could outperform conventional systems. The reason for this superior activity comes about, we believe, due to a change in reaction mechanism when osmium cluster catalysts are used. Because the cluster has a limited number of sites the ethane may not fully dissociate (that is $C_2H_6 \rightarrow$ C-C + 6H), as is the case with conventional osmium catalysts, but retains most of its hydrogen prior to C-C bond rupture.

The Future

Research is continuing and will continue into heterogeneous catalysis by supported metal cluster compounds but the era of them being the "great white hope" for catalysis, if it ever existed, is now dead. These catalysts should be studied for their own sake and for the insight they can give into conventional catalysis but not as the wonder catalysts of the future. Only in the area of structure sensitive reactions do cluster catalysts hold any promise in terms of "applied catalysis" and even here the activity and/or selectivity enhancement would have to be spectacular to overcome the negative aspect of cluster production on a large scale. Even so, cluster catalysts do exhibit novel behaviour, an understanding of which may lead to a questioning of long held beliefs in catalysis or greater insight into areas which are ill understood. Support interactions is one area where we believe cluster catalysts may give us information not readily available from conventional catalysts. Site interactions, which are exceedingly difficult to study in conventional catalysts, are far more open for study when the number of atoms in a cluster is limited, the ligands specified and the geometry known. None of these answers will be easy to obtain but the possibilities are there for using cluster catalysts to help our understanding of fundamental aspects of catalytic chemistry.

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Transparent Platinum Films

When prepared by a conventional evaporation technique, a film of platinum 33 nanometres thick will transmit only about 3 per cent of light. However, workers at two Bell establishments in Murray Hill, New Jersey have reported that the same thickness of film prepared by photoelectrodeposition onto indium phosphide can transmit as much as 92 per cent of light at wavelengths between 210 and 750 nm (A. Heller, D. E. Aspnes, J. D. Porter, T. T. Sheng and R. G. Vadimsky, *J. Phys. Chem.*, 1985, **89**, (21), 4444–4452).

Although this high transparency is due partially to porosity in the film, it is achieved mainly by controlling the microstructure of the deposit so that the particles which make up the film are small, compared with the wavelength of the light, and are not well connected.

The work reported may lead to several new areas of research.