energy dissipation effects related to hydrogen mobilities, which had been measured over a wide range of hydrogen contents in the palladium-hydrogen system, were reported by F. M. Mazzolai, P. G. Bordoni and F. A. Lewis of the Istituto di Acustica, Rome and Belfast.

The permeation of hydrogen through membranes of palladium and palladium alloys continues to be actively investigated. Effects of cold-rolling on the diffusion of tritium through palladium were reported by B. Huber and G. Sicking of the University of Münster. Influences of hydrogen solubilities on permeation through palladium-rare earth alloys were discussed by D. T. Hughes of the U.K. Electricity Council Research Centre, J. Evans and I. R. Harris, of the University of Birmingham, England, and the efficiencies of palladium overlayers in promoting hydrogen uptake into niobium and tantalum by M. A. Pick, M. Strongin and M. G. Greene, of the Brookhaven National Laboratory, U.S.A. Apparently extensive studies by E. M. Savitsky and other Russian workers were reported in abstract, concerning the use of membranes of palladium alloyed with ruthenium, rhodium, nickel and copper as hydrogenation catalysts. High efficiencies and selectivities were claimed.

Papers presented at the symposium will be published later this year in the *Journal of Less-Common Metals*. F.A.L.

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1 Third World Hydrogen Energy Conference Tokyo 23–26 June 1980

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Platinum-Based Bimetallic Catalysts

THE ROLE OF THE SECOND COMPONENT

The operation of petroleum reforming has been revolutionised in the past decade by the introduction of greatly improved catalysts. A general feature of this new generation of catalysts is that while they all contain platinum as the principal active component, they also have one or more further components, for example rhenium, germanium or tin, which may be regarded as promoters and which serve to increase the life of the catalyst. Although this effect has occasioned much research, there are many features still awaiting clarification. In a lecture at Imperial College, U.K. on 14 April 1980, Dr. Paul Biloen of the Royal Dutch-Shell Laboratory, Amsterdam, reviewed the present state of knowledge of how promoters work, with particular reference to recent work carried out in Amsterdam on the platinum-tin system.

In this programme the reactions of n-hexane, that is hydrogenolysis, isomerisation and dehydrocyclisation, were studied using several platinum, platinum-tin and tin combinations supported on **non-acidic** materials (silica and sodium-poisoned alumina): thus the acidic function was eliminated, and effects associated with the metallic components were isolated. Measurements of the decrease in the rates of benzene formation with various catalysts definitely showed that the presence of tin reduces the amount of carbon on the metal. The question is, how? Temperature-programmed reduction of a reduced platinum-tin catalyst after gentle reoxidation, in comparison with supported platinum and tin separately, provided strong circumstantial evidence that some alloying of the two metals had occurred. However not all the tin was used in this way: a small amount, about 0.6 weight per cent, remained associated with the alumina support in an irreducible form. Dr Biloen believed that the principal role of the tin was to reduce the average size of ensembles of platinum atoms. More than three atoms of platinum together can probably lead to dehydrogenated and strongly bonded species which are precursors to carbon deposition. Single platinum atoms in platinum-tin alloys have been shown to be active centres in dehydrogenation, and tin-promoted platinum catalysts are more highly selective in dehydrogenation than platinum alone. The inhibition or modification of carbon deposition by the second component goes far towards explaining its beneficial effect. G.C.B.