

hydrogen into the bulk is blocked by adsorbed oxygen, and the reaction rate is reduced.

Several papers were concerned with the detailed atomic arrangement at clean surfaces of platinum group metals. G. Comsa, of KFA Jülich, has scattered helium atoms from a clean platinum surface cut at a small angle to the (111) plane and found direct evidence for an upward bending of the terrace planes of atoms in the vicinity of the downward steps. J. Küppers, München, described work on the recrystallisation of the iridium (100) surface into a (5×1) superlattice while G. Allan, Lille, reported theoretical studies of the atomic relaxation at a platinum surface.

Two papers recorded quantum mechanical

calculations of the interaction between platinum and chemisorbed species. D. W. Bullett and E. P. O'Reilly of the Cavendish Laboratory described theoretical studies to compare and contrast CO chemisorptive bonding at surfaces with the bonding of CO to metal atoms in cluster carbonyl molecules such as Pt<sub>3</sub>(CO)<sub>6</sub> and Os<sub>6</sub>(CO)<sub>18</sub>. Embedded cluster calculations to model the chemisorption of hydrogen on palladium and platinum were presented by J. P. Muscat of Imperial College.

The proceedings of ECOS 2 will be published by North Holland in a special issue of *Surface Science*, and the third European Conference on Surface Science will be held in Cannes in September 1980.

## The Future Availability of the Platinum Metals

Civilisation as we know it today is highly dependent on the use of metals that exist only in finite amounts, and which therefore must be used in a responsible way. In recognition of this fact a conference entitled Future Metal Strategy, organised by The Metals Society, was recently held in London to provide an international forum for the discussion of many of the vital factors that may influence the supply and utilisation of a number of the more important metals during the next twenty years. In one of the papers, by Dr. J. E. Hughes, Deputy Managing Director of Johnson Matthey & Co Limited, Dr. G. J. K. Acres, Manager of the Johnson Matthey Research Centre, and Miss M. T. Herbert, the future supply and demand situation for the platinum group metals was reviewed.

The authors explained that over 98 per cent of the world's output of the platinum group metals is obtained from just three countries, South Africa, Canada and the U.S.S.R., while no less than 65 per cent of the total output of platinum alone is mined from the Merensky Reef of the Bushveld Igneous Complex in South Africa. Existing reserves, that is the known deposits at present being mined, are believed to contain sufficient platinum to last for some 150 years.

When considering both the present and the future availability of the platinum group metals it is most important to remember that

the amounts of palladium, rhodium, iridium, osmium and ruthenium mined are directly proportional to the output of platinum in the case of the South African production, or of nickel in the case of Canadian and Russian material. This is because at present prices it is not economic to mine for them as principal products. The current production of platinum group metals from the Merensky Reef is approximately 93,000 kilograms per year, the composition including: platinum 60, palladium 25 and rhodium 4 per cent.

In addition to the platinum deposits of the Merensky Reef, platinum group metals also occur at two other horizons in the Bushveld Igneous Complex. These are the Upper Chrome Group and the Platereef, and although they are largely unexplored and unmined it is estimated that, if the metals can be extracted economically, the total resources could then last for 400 years.

The usefulness of the platinum group metals to industry is based on their unique properties, including catalytic activity, high melting points and chemical inertness over wide ranges of temperature. Existing and future applications include such topical areas as energy generation and conservation, fertiliser production and pesticide manufacture, pharmaceutical preparation and anti-cancer therapy, the control of noxious emissions and the cathodic protection of ships and other steel structures.