gauzes, used as catalysts in the oxidation of ammonia, will be given.

On occasions rhodium-platinum gauze packs have been reported as giving anomalously low conversion efficiencies after only a short period of plant operation. This effect is normally associated with medium and high pressure plants and until recently could not be accounted for either as a catalyst or as a plant problem.

By the application of electron probe analysis, scanning electron microscopy and X-ray diffraction an explanation has now been found, and is illustrated in Figures 12, 13 and 14.

Figures 12 and 13 show the EPMA distributions of rhodium in a gauze with normal activity and one with reduced activity. These results immediately suggest a rhodium enrichment factor. SEM photographs of three gauzes having normal, intermediate and low activity are shown in Figure 14, and indicate two forms of surface structure, namely platelets and needles. Additional XRD data shows the platelets to be essentially 10 per cent rhodium-platinum, while the needles consist of rhodium oxide (Rh_2O_3). An explanation of the formation of rhodium oxide has been given by Schmahl and Minzi, who studied the relationship between the decomposition of rhodium oxide and oxygen pressure and temperature, for rhodium-platinum alloys. This work showed that rhodium oxide is stable only below temperatures in the 800 to 900°C range depending upon the partial pressure of oxygen. Thus the problem becomes one of plant operating conditions; both the temperature and the ammonia-to-air ratio must be controlled so that rhodium oxide is not formed.

Finally the use of a special gas reaction cell, on a transmission electron microscope, to study the behaviour of platinum or rhodium-platinum was illustrated. The purpose of the experiments was to examine how surface rearrangements of the gauze take place, and in particular the mechanism of whisker formation.

A film recording these effects was shown at the conference to demonstrate that industry will turn even a transmission electron microscope into a nitric acid plant in order to use all appropriate physical techniques as a means of improving industrial catalytic processes.

The full text of this address, including references to earlier work, and of the other papers given at the Characterisation of Catalysts course are to be published by John Wiley & Sons Limited, Chichester, in 1980.

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Electrodeposited Ruthenium Contacts for Electronic Applications

Considerable advances have been made in recent years in the improvement of electroplating processes and in the selection of metals for deposition to meet design and economic requirements in the electronics industry. A review of progress in this field by R. G. Baker of Bell Laboratories and R. Sard of Oxy Metal Industries (*Plating and Surface Finishing*, 1979, **66**, (8), 36–40) draws attention to the potential advantages of ruthenium as an electrodeposit where low and stable values of contact resistance are required in electronic systems.

As well as providing a significant reduction in cost as compared to gold for an equal thickness of deposit, ruthenium has an extremely thin and adherent film of oxide which not only prevents polymer formation in operation but possesses a low contact resistance virtually the same as the parent metal. The system is resistant to corrosion by the media normally used for testing and those met within service. It also shows good resistance to wear.

Several electrolytes are now available for the deposition of ruthenium, and work is proceeding to improve their stability and current efficiency in production conditions.