while. Some of the sensible heat in the converted gas is used for preheating the gases going to the catalyst but the heat of reaction is available for other purposes. Initially this heat was recovered as steam in waste heat boilers. By the use of economisers the heat recovery can be made effective to about 82 per cent of the heat of oxidation of ammonia but cannot be taken further because of the dewpoint of the converted gases.

When plants are operated under pressure it is possible to recover the heat of reaction as mechanical energy by heating the exhaust gases and using them to drive a turbine. Because of the characteristics of heat engines the amount of energy which can be usefully recovered in this way is limited and for the relatively low pressure plants which are now favoured the major part of the heat available is recovered as steam with a small part recovered as mechanical energy at a very high conversion efficiency.

The oxidation of nitric oxide to nitrogen dioxide is responsible for about 15 per cent of the total heat evolved in converting ammonia to nitric acid. This heat is usually evolved at low temperature and lost to cooling water because of the negative temperature coefficient of the reaction velocity constant. However, when the process is operated under increased pressure it becomes practicable to raise the working temperature to the point where this heat can be usefully recovered. At the present time this would appear to represent the limit to which the energy of reaction can be recovered.

Platinum Plating of Zirconium

PROTECTION FROM CORROSION UNDER IRRADIATION CONDITIONS

Studies on the use of zirconium and its alloys for the construction of spherical shells for a homogeneous reactor at Oak Ridge National Laboratory have shown that these materials corrode slowly in uranyl sulphate solutions of pH 1.7 to 2.5 in the temperature range 250 to 350°C under irradiation conditions. It was thought that a platinum cladding would be sufficiently resistant in these conditions and an investigation was therefore carried out at Battelle Memorial Institute. The results of this study are reported by A. B. Tripler, J. G. Beach and C. L. Faust in the U.S. Atomic Energy Report No. BMI-1097.

Mechanical cladding was temporarily ruled out because of the brittle alloy phase which forms at cladding temperatures and electrodeposition was therefore investigated. It was essential that the deposit should be adherent, continuous and impervious, should resist corrosion under irradiation and should not exceed the thermal neutron capture cross section equivalent to 0.25 inch of zirconium.

A diammino-nitrite bath was used, containing 6 g platinum in 750 ml, with platinum foil anodes. Preliminary plating tests on nickel showed a continuous D.C. method to give an unsatisfactory deposit. A periodic reverse technique was therefore employed. After establishing optimum conditions of current density and time cycle, dense lustrous deposits were obtained up to 0.0015 inch in thickness.

With a satisfactory method of deposition established, plating of zirconium was undertaken. Studies were made of duplex plates of 0.0005 to 0.00075 inch platinum over 0.001 inch nickel, diffusion bonded to the zirconium, and of deposits of 0.0005 inch platinum directly on to zirconium. Both types were found to be adherent and resistant to corrosion, but microscopic examination showed that the platinum on nickel deposit was much smoother than the direct platinum deposit.

On the basis of these results a procedure involving periodic reverse platinum plating over diffusion bonded nickel was used for the preparation of specimens sent to Oak Ridge for in-pile testing. If necessary, the thickness of platinum could be increased.