including of course the three principal platinum alloy combinations chosen for their resistance to oxidation, high melting points, reproducibility and long life up to as high as 1500°C. The newer combination—6 per cent rhodium-platinum against 30 per cent rhodium-platinum—has now been standardised for some years, primarily for use in the range 1250 to 1750°C, where it exhibits better mechanical strength and stability by comparison with the old established 10 and 13 per cent rhodium-platinum alloys against high purity platinum. These authors also draw attention to some modern applications of thermocouples to illustrate the severe requirements imposed by today's technology, including their use in nuclear environments, in glass manufacturing plants where temperatures of 1570°C are reached, and in high temperature tunnel furnaces used in the production of ceramics and ferrites. The 6:30 rhodium alloy couple has also been used for measuring gas-stream temperatures as high as 1750°C in the development of jet engines, while it is finding applications in the expendable thermocouple devices for instantaneous molten metal temperature measurements in the steel industry.

Many of the other papers in this volume have to do with the finer points of precision thermometry and the further development of the International Temperature Scale, an amended version of IPTS-68 being promised at the turn of the year. Precision thermometry has now become exceedingly complex and may seem somewhat remote from the practical needs of temperature measurement in industry, but much of the work described in these papers should none the less be of interest to both manufacturers and users of resistance thermometers and thermocouples.

L. B. H.

The Electroless Plating of Plastics

Significant advances in the plating of plastics with metals such as copper and nickel have been made since the introduction of the "one step" process in which the sensitiser and the activator are applied to the substrate by immersion in a solution containing palladium chloride and stannous chloride in hydrochloric acid. This mixed system was first developed in 1961 by C. R. Shipley, who maintained that the solution contained colloidal particles which, when adsorbed on the surface of the work, provided catalytic sites for the metal to be deposited. Later workers have claimed, however, that their catalyst systems are true solutions and that their activity is due to the presence of soluble tin-palladium complexes.

Controversy on this point has continued, but a paper by E. Matijević and P. Zuman of the Institute of Colloid and Surface Science at Clarkson College of Technology and A. L. Poskanzer of the Shipley Company, Newton, Mass., now shows not only that these solutions do contain colloidal particles but that, on separating these out in an ultracentrifuge, they are active while the supernatant solution is not (*Plating*, 1975, **62**, (10), 958–965).

A total of 16 $PdCl_2/SnCl_2$ systems were investigated, all samples being put through the ultracentrifuge at 25,000 r.p.m., and the two phases were separated for further examination. Ten of the solutions, as prepared before separation, were studied by electron microscopy, and all showed the presence of colloidal particles. Light scattering, which has been used by other workers as a test for the presence of colloidal particles in such catalysts, was found not to be a satisfactory means of discrimination.

Assessment of activity was carried out with all the samples, using epoxy laminated boards and copper plating after standard cleaning and sensitising procedures. Each formulation was aged for one week, separated in the ultracentrifuge, and the residue and supernatant fractions tested separately. In all cases the supernatant liquor showed no activity, while all the residues were highly active.

As the authors conclude, systematic chemical analysis of the colloidal particles present in these proprietary catalysts would seem to be highly desirable if the precise mechanism of their activity is to be established.