near future as it offers economic advantages.

The assessment of a metal powder for a particular application requires further characterisation in addition to measurements of surface area, tap density and particle size distribution. The determination of oxide layers or the presence of surface contaminants which may interact harmfully with any dielectric material requires the use of X-ray Photoelectron Spectroscopy. Transmission Electron Microscopy and X-ray Diffraction are used for the determination of fundamental crystallite size, which incidentally provides information on the particle growth mechanism. The presence of bulk impurities which can drastically alter MLCC performance is determined by X-ray Fluorescence Spectroscopy, in addition to the traditional methods of chemical analysis. Finally, Simultaneous Thermal Analysis and Dilatometry are used to examine sintering and shrinkage behaviour.

The investigations carried out at the Johnson Matthey Technology Centre have involved mainly palladium and silver-palladium, reflecting the importance of the platinum group metals in the manufacture of MLCC electrodes. This work has provided a better understanding of the fundamental aspects of precipitation of these metal powders, which can also be utilised for other applications such as improved MLCC end terminations and hybrid interconnect metallisations. The electronics industry requires and demands high purity powders of advanced formulation for existing and predicted future applications; it is knowledge gained from investigations such as these recorded here that will enable the constantly changing needs of this important industry to be satisfied.

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Oxygen Probe for Heat-Treatment Furnaces

In earlier times steel was heat-treated by craftsmen who depended largely upon their accumulated knowledge to ensure that the properties of the metal matched the application. Present day requirements demand more exact control, not only of temperatures but also of furnace atmospheres, for if the latter is chemically unsuitable the composition and hence the physical properties of the steel will be adversely affected.

To provide a reliable and accurate indication of available carbon in furnace gases Corning Glass Works, of Corning, New York, U.S.A., have now developed a solid state oxygen measuring probe. Somewhat similar probes find application in chemical process technology, and can assist in vehicle emission control.

The Corning Glass probe includes a yttria stabilised zirconia solid electrolyte and a platinum electrode which is exposed to the furnace atmosphere. Oxygen molecules in the furnace are turned into ions by the catalytic effect of the platinum and are then conducted through the zirconia where they recombine into molecules, the electrical potential generated depending upon the difference in the amounts of oxygen inside and outside the furnace. The oxygen produced in the furnace is directly related to the concentration of carbon monoxide and carbon dioxide, and thus to the amount of carbon available for hardening steel by carburising and carbonitriding treatments.

Operating in the range 760 to 1100°C, the probe can be used with furnace atmospheres generated from natural gas, nitrogen+methanol mixtures and propane-derived gases.

In the U.K. the Corning Glass probe is marketed by Land Pyrometers, Dronfield, Sheffield S18 6DJ, from whom additional information is available.