

likely to attack the sheath and also providing opportunities for high temperature. Lance coating techniques have had to be evolved to enable the lance to be freely withdrawn from the furnace and coatings have also been used on the sheath to prolong their life. This was especially necessary when immersion commenced on oxidising slags. This has proved successful, although immersion throughout oxygen lancing has not been tried very often.

In a routine operation the probe will be introduced to the furnace soon after clear melt, and removed for lancing and slagging off. The lance will then be reintroduced when the reducing slag has been made up, and not withdrawn until tap. The melter will know throughout the cast the temperature of the steel and at the end the sheath should be perfectly satisfactory for a further cast.

The current work is based on the iridium: iridium-rhodium thermocouple and its development for high temperature work. Arrangements are being made to use this technique on the new 120-ton arc furnaces at Steel Peech and Tozer, where considerably longer immersion times will result. It will also be possible to use the temperature of the steel to control power input to the furnace.

Acknowledgements

Acknowledgement is made for the design of the water-cooled probes to the Fuel and Furnace Research Section of the Research and Development Department, United Steel Companies Limited. The author wishes to thank Mr T. S. Kilpatrick, General Manager, Steel Peech and Tozer, for permission to publish this work.

References

- | | | | |
|---|-----------------|---------|--|
| 1 | J. D. Sharp | | Continuous Temperature Measurements of Liquid Steel. <i>Iron and Steel</i> , 1962, Dec. |
| 2 | J. Ravenscroft | | Programming and Automatic Control of Electric Arc Furnaces. <i>Iron and Coal Trades Rev.</i> , 1960, 955 |
| 3 | J. A. Stevenson | | Temperature Measurement with the Expendable Immersion Thermocouple. <i>Platinum Metals Rev.</i> 1963, 7, (1), 6. |

Polarisation of Platinum Electrodes

IMPEDANCE IN CHLORINE-CHLORIDE SYSTEMS

The reactions at platinum electrodes in aqueous solutions of halides when an alternating potential is imposed are complex and have been a continuing source of interest for many years to J. Llopis and his collaborators at the Instituto de Química Física "Rocasolano" in Madrid.

In their most recent paper (*Electrochimica Acta*, 1963, 8, 163-174), Llopis and M. Vázquez report the results of a study of the changes in electrode impedance in aqueous solutions prepared from mixtures of 0.5 M perchloric acid saturated with chlorine, 0.5 M perchloric acid, and hydrochloric acid. The working electrodes were platinum wires carefully arranged in the axis of a cylindrical ancillary electrode of platinised platinum to ensure regular distribution of the current flow.

Measurements of impedance were made of

a special hermetically-closed cell having a very small gas volume at frequencies ranging from 20 to 20,000 cycles/sec and the results were analysed in an attempt to determine which of a series of equivalent resistance-capacity networks (the components of which are shown to correspond to different types of electrode reactions) best approximated to the observed results.

One clear conclusion was that in the system Cl_2/Cl^- surface oxidation of the platinum electrode hinders establishment of the equilibrium potential. It is still not clear, however, whether this effect is due simply to loss of active adsorption sites through the blocking of part of the surface by oxidation, or whether the values of the free energy barriers which control the electron-transfer process at the electrode interface are changed.

J. C. C.