the mould and before it is fired a few extra turns of wire are wound round the outside at each end to ensure that the ends are fired properly. These extra turns are removed before the element is inserted in its furnace.

If cracks develop in an element coating during use they should be covered with more cement slip, as maintenance of an even and impervious coat over the wire is the main factor needed to ensure a long life, but the grading of the refractory used ensures a low shrinkage and it is very rare for cracks to develop in the outer part of the element. The slip coating gives adequate electrical insulation to enable samples to be heated in platinum vessels placed on the floor of the muffle and these are invariably used. The temperature variation along the central 5 cm length of an element is less than 20°C, and with proportional controllers the temperature can be maintained to within 2°C for several hours.

The furnace cases are lined with high temperature insulating bricks and the element is surrounded by about 5 cm of alumina powder. The temperatures of the furnaces are controlled by various proportional controllers. An electromechanical type described by Nurse and Welch in 1950 (1) has been extensively used, and a more precise saturable reactor type gives the very close temperature stability (± 0.1°C) required for quench furnaces. The temperatures of the furnaces are measured by 5 per cent rhodium-platinum : 20 per cent rhodium-platinum thermocouples and read on an electronic recorder.

The work described formed a part of the programme of the Building Research Station and the paper is published by permission of the Director.

Reference

1 R. W. Nurse and J. H. Welch, *J. Sci. Instrum.*, 1950, **27**, (4), 97

Platinum-clad Isotope Fuel Capsule for Space Applications

As one of its long term objectives NASA continues to support work on radioactive heat sources and a recent report by Atomics International (USAEC Rept. NAA-SR-12578) provides some interesting preliminary design data for a proposed test capsule capable of holding a large (undisclosed) heat source and operating in a space environment for more than five years with a surface temperature of approximately 1090°C.

The total assembly, in the form of a cylinder with hemispherical ends is 7.37 inches long and 1.72 inches in diameter. The isotope heat source is centrally disposed, surrounded by a tantalum honeycomb and finally welded into a thick walled tantalum alloy shell which provides the strength for long term helium containment and for impact survival. An external covering of 10 per cent rhodium-platinum alloy, 0.020 inches thick, protects this shell from oxidation. Metallic diffusion between the tantalum and platinum alloys is inhibited by a thin layer of vapour phase deposited alumina. The outer surface of the platinum alloy is coated with a layer of iron titanate to increase heat emmissivity.

Paradoxically enough the design of this capsule was complicated because of its low operating temperature, no reliable creep data on rhodium-platinum alloys tested below 1200°C having yet been published. The designers extrapolated downwards with respect to temperature and outwards by a factor of 45 with respect to time. In concluding that hoop stresses in the rhodium-platinum sheath should be kept below 75 pounds per sq. inch they emphasise the uncertainties involved in their assumptions.

The compatibility studies scheduled in this report will be made in vacuum of 10^{-8} Torr for periods up to 2200 hours. In both geometry and environment these test conditions depart from those existing inside the proposed capsule. It will be interesting therefore to read in subsequent reports whether the reactions between tantalum, alumina and rhodium-platinum tested in close association inside the capsule in a helium atmosphere differ significantly from those which occur in vacuum where the reaction products are continuously removed.

A. S. D.