It is hoped that these findings are useful for experimental verification, especially at low gamma energies, where no experimental data are available.

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A furnace with uniform temperature region for a horizontal X-ray diffractometer

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In this paper a simple diffractometer furnace assembly is described which can be built from materials available in ordinary laboratories. The sample holder can be detached at will. The heater can also be removed with the sample holder in position. Complete range of 2θ angles (0° to 180°) can be investigated. The furnace, using nichrome wire, is used upto 800°C but with Pt-10% Rh winding the range can be extended to 1200°C. The furnace assembly is designed to fit the horizontal diffractometer made by Rich. Seifert, Germany.

The heater is shown in figure 1. A porous pot used in Daniel Cells was cut from both sided so as to obtain a cylinder of about 8.5 cm. in length and 5 cm. in diameter. A slot was cut along its length, as shown in the figure, for X-rays to enter and leave. The heating element consists of nichrome wire of S. W. G. 26. The element is in the coiled coil form inside the furnace and straight outside. The distance between two consecutive coils and the pitch of the coil were so adjusted, especially near the slot as to obtain a region of as uniform a temperature inside the furnace as possible.

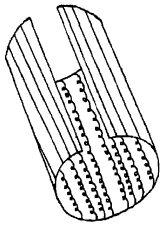

Figure 1

The heater is placed on an asbestos cement disc E (figure 2) of about 15 cm. diameter. Four pegs A B C D (C D not shown) are screwed on the disc to fix the position of the heater (shown dotted). The asbestos disc is placed on a hollow metal disc M of the same diameter and height about 1 cm. During the experiment cold water is continually circulated through this disc in order to prevent the heat of the furnace from reaching the main body of the diffractometer. Two pillars P_1P_2 carry the specimen holder as shown. The fused silica rods R_1R_2 rest in specially designed grooves in the pillars.

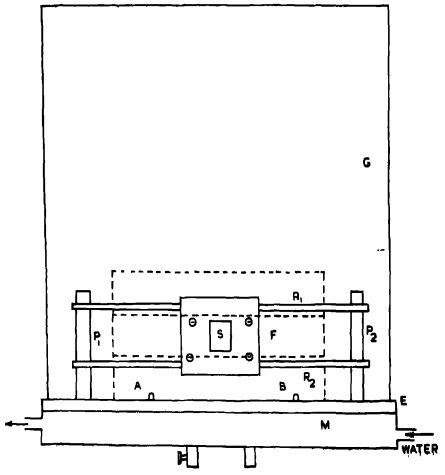

Figure 2

The specimen holder F consists of a slice of size about 3.5 cm.×3 cm. × 0.3 cm. cut from an insulation brick of a burnt out muffle furnace. A hole S of size 1.0 cm. × 1.3 cm. was cut through it. On its back side grooves are made to carry the fused silica rods R_1R_2. The back side is then covered by a thin sheet of platinum. The specimen in the form of powder is filled in the groove S. The thermocouple consisting of Pt-Pt 10% Rh is placed in contact with the front surface of the specimen. The pillar P_2 can be moved perpendicular to the plane of the paper by about 0.5 cm. by a screw adjustment in order to bring the front surface of the specimen along the central vertical axis of the diffractometer.

The whole furnace assembly was covered with a copper cylinder G. A slot about 2 cm. wide and 180° in circumference was cut in the cylinder and covered with aluminium foil.

The inside region of the furnace was investigated with a Pt-Pt 10% Rh thermocouple at different temperatures. Typical results of such an investigation are shown in figure 3.

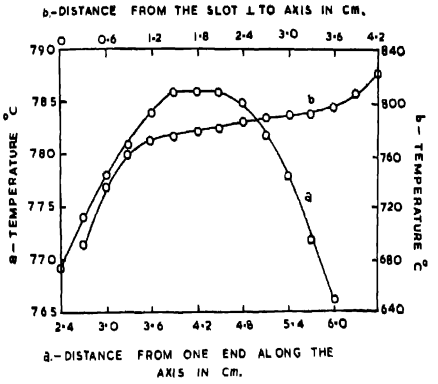

Figure 3

It is seen from figure 3 that between 3.5cm. and 4.9cm. a region of fairly uniform temperature is obtained. The variation of temperature between these extreme points is about 3°C. From the same figure it is seen that the region between 2.1cm. and 2.7cm. (depth of 0.6 cm.) is again of fairly uniform temperature, the difference of temperature being only 4°C. In view of the fact that the specimen thickness is about 0.3 cm. and X-rays normally penetrate only through about 0.01 cm. of the specimen, the design of the furnace was considered quite satisfactory.