PROBLEM OF A METHOD OF X-RAY ANALYSIS FOR SUBSTANCES UNDER HIGH PRESSURE

II. APPARATUS FOR THE PRODUCTION OF POWDER PATTERNS UNDER PRESSURES UP TO 18,000 kg/cm² *

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(Received 5 February 1962)

The design of a new apparatus is discussed for the X-ray analysis of polycrystalline substances under high pressures

The majority of effects which take place under high pressures are reversible. X-ray diffraction patterns of crystalline solids under direct pressure are of considerable interest in finding out what occurs in solids under compression. Such investigations provide direct information regarding the changes in crystal lattice parameters, the nature of phase transformations etc. etc. It also helps to clarify our ideas regarding the mechanism of the compressibility of solids and other mechanisms connected with the behaviour of a crystal lattice under pressure. However, despite the considerable scientific value of X-ray studies at high pressures only a minute number of works have been carried out in this field, due to experimental difficulties.

Papers [1-7] describe a number of designs for high pressure equipment for X-ray analysis, but not one of them pretends to provide a complete solution to the problem of obtaining X-ray diffraction patterns from any crystalline substance in a sufficiently wide range of pressures.

In the X-ray apparatus which we will here describe a beryllium high pressure vessel of original shape was used, and it was designed so that it could be rigidly fixed. There is also a special system of adjustment and a system for checking the X-ray chamber [8] in the apparatus. The aperture in the beryllium chamber can be adjusted to different sizes depending on the optimum depth of the test specimens. The design provides for rotation of the specimen under pressure. The apparatus is comparatively simple in construction and it permits assessment of the pressure level inside the chamber in a comparatively narrow range of pressures; it is transportable and the film can be recharged without relieving the pressure.

General description of the apparatus. The general appearance and details of the apparatus are shown in Figs. 1, 2 and 3. It consists of steel plates, *1*, *4* and *16*, joined together by three columns, *2*. Between plates, *4* and *16* there are supports, *9* and *14*, which are made of steel 45KhNMFA. Between these columns in its turn is the high pressure chamber, *24*, which is usually made of beryllium (the space between the supports in our experiments was 1.5-2 mm). The components between plates, *4* and *16*, are attached to one another by means of the upper screws of column, *2*. The magazine, *10*, with X-ray film, *13*, is attached to the conical surface of the lower support, *9*, together with ring, *20*, which holds the film against the casing of the cassette and is also used for disposing the filters. The magazine is tapered to 6°. There are hollows with a taper of 30° in the supports for the beryllium chamber. Figs. 1 and 2 show the arrangement of the collimator with diaphragm, trap, bushings with fluorescent screen and protective lead glass, which are usual for Debye cameras.

Dynamometer, *3*, with watch-type indicator and graduations of 0.002 mm is placed between plates, *1* and *4*. It is used to measure the force transmitted to the specimen through the system of upper and lower pistons and the medium between

* *Fiz. metal. metalloved.*, 14, No. 1, 80-84, 1962.