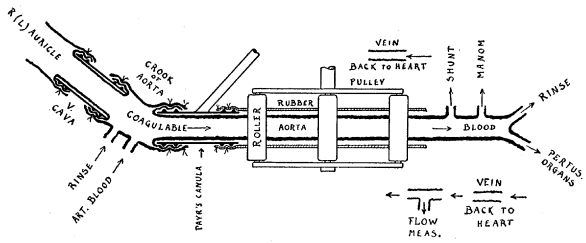

FIG. 1. Artificial heart with coagulable blood.

The subclavian artery is connected with a reservoir of saline or blood to rinse the air out of the preparation. The innominate is either tied or connected with an artery to introduce arterial blood into the preparation. Into the large end of the aorta, a Payr's cannula of 15-mm diam, coated with a vena cava, is introduced and tied. The other end of this cannula is introduced into the auricle, right or left, according to which sort of blood one wants to pump out of the heart.

The rubber tubing which protects the aorta rests by means of a layer of moss rubber on a flat groove. The roller-pulley can be raised or lowered by a screw so that the rollers as they rotate exert more or less pressure on the aorta (systolic output), and the speed of the pulley can be regulated to vary the number of beats. The diameter of the pulley is 65 mm and there are six rollers of 8-mm diam. In order that the aorta may not slip off, the cannula on which it is tied is itself fixed on the apparatus.

The output of such a heart can easily reach 700–1000 ml/min, against a pressure ranging from the normal level up to 300 mm. Up to the present it has been used to perfuse kidneys with arterial blood under varying pressures, or with venous blood at arterial pressure. Brief results of these experiments will be published at the International Congress of Physiology in 1950.

Reference

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Hollow Crystals of Nitroguanidine[1]

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The irregular formation and occurrence of voids and internal imperfections in crystals have been observed frequently. However, the consistent and reproducible formation of regular-shaped cavities along the entire length of a crystal has not been previously observed, to our best knowledge. We have found recently that under certain conditions nitroguanidine crystallizes from solution as

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[2] The authors wish to acknowledge the assistance of Messrs. Don MacLaghlan and Al Uremovich, who prepared the thin sections and the photomicrographs.

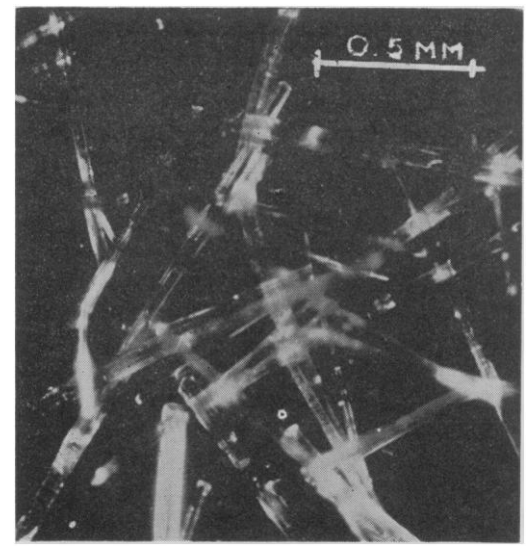

FIG. 1. Photomicrograph of nitroguanidine.

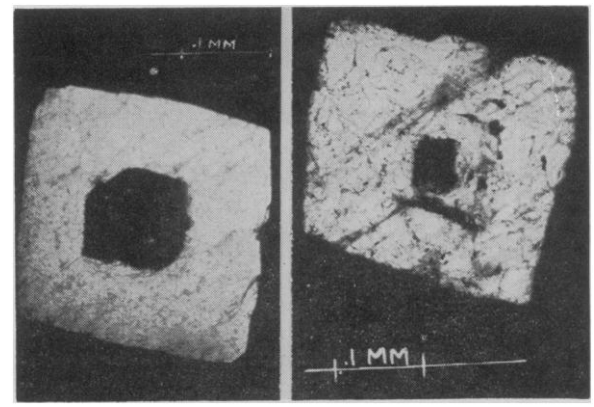

FIG. 2. Photomicrographs of thin cross sections of hollow nitroguanidine crystals.

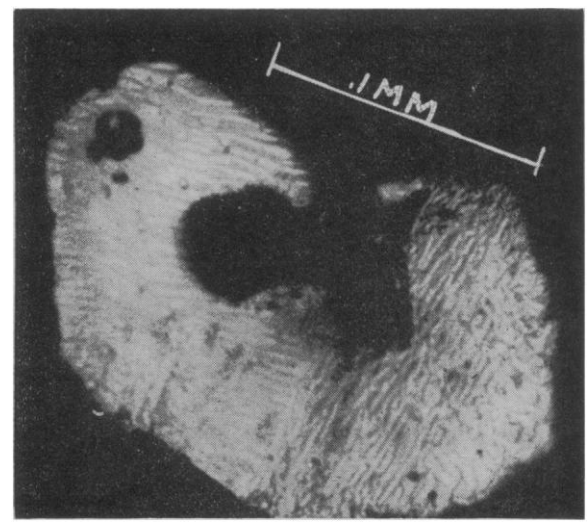

FIG. 3. Photomicrograph of a thin cross section of an incompletely formed hollow nitroguanidine crystal.

long, hollow, flexible needles (Fig. 1). The solvent used is a 1.2% aqueous solution of acetic acid; the concentration of nitroguanidine is 5 g/l, and the cooling time, from 95° C to 30° C is 5 hr, with no agitation. The resulting needles are not single crystals but appear to be aggregates of crystals.

Photomicrographs of cross sections made by embedding the needles in plaster of Paris or very hard wax and grinding thin sections perpendicular to the long geometric axis of the needle are shown in Fig. 2. From a study of a large number of cross sections it appears that the boundaries of the cavity are always parallel to the external faces of the aggregate, and that the respective numbers of faces are the same. That is, if the cross section of the aggregate is hexagonal, the cavity will be hexagonal; or, if the cross section is square, the cavity will also be square. A photomicrograph of the cross section of an incompletely formed hollow aggregate is shown in Fig. 3.

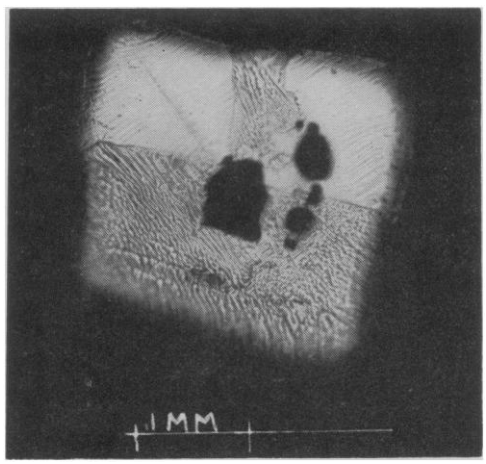

FIG. 4. Photomicrograph of the same cross section as shown in Fig. 2 on right, but after etching with water.

The presence of the cavity throughout the length of the aggregate is easily demonstrated in another way. If one end of the aggregate is dipped into an aqueous dye solution, the colored solution can be seen to ascend the bore of the aggregate, due to capillarity. Under the microscope a well-developed meniscus is readily seen. Frequently, the ends of the cavity are partially or completely closed because of crystallization, in which case it is necessary to trim the ends of the aggregate before the capillary can be revealed.

In any given crystallization under the conditions described, approximately 70%–80% of the needles will have well-defined cavities. If the crystallization is conducted from water rather than dilute acetic acid, the percentage of hollow aggregates is small (10%–15%). The influence of concentration or of the rate of cooling on this phenomenon has not been investigated. No effort was made to ascertain the minimum crystal size that still possesses the cavity; however, some aggregates with diameters as small as 0.2 mm have been hollow.

The formation of these hollow aggregates is probably due to a lengthwise contact twinning, involving two or three crystals. If the cross sections are carefully etched with water, groups of parallel striations appear, which are independent of the direction of grinding, and which appear to define the individual crystals composing the hollow needle (Fig. 4).

Cursory examination indicates that some of the long flexible needles of sublimed phthalic anhydride are also hollow.

Vacuum Differential Thermal Analysis[1]

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Differential thermal analysis is a technique for studying certain thermal characteristics usually of a solid complex substance. The procedure consists of heating the material under investigation at a constant rate to about 1000° C and recording the temperatures at which exothermic and endothermic reactions occur. In practice this is most readily accomplished by employing a metallic block with two holes, one of which is packed with the unknown substance, while the other is packed with an inert powder such as γ-alumina. A two-headed thermocouple, one head of which is imbedded in each powder, is then used to determine the direction and extent of the differential changes as the block is heated at a constant rate in a furnace.

During recent years differential thermal analysis has become a standard analytical procedure for the study of complex mixtures of minerals when resolution is difficult by conventional microscopic techniques or by x-ray methods. It has been especially useful in analysis of clays and other colloidal materials.

During the course of studies on coals and organic shales it became evident that any simple analysis or set of analyses leads only to generalized indication of the structure and stability of the gross organic material. Difficulty is enhanced by the fact that these organic substances, derived to a great extent from colloidal gels, appear homogeneous under the microscope. Differential thermal analysis has proved after trial (*1–3*) to be a promising technique for such studies, but certain difficulties were encountered in determining the thermal characteristics of the organic complexes on account of combustion of the specimens. For this reason a new instrument for differential thermal anlysis was designed to operate under vacuum or inert atmosphere. This paper describes such a vacuum installation, its furnace, and control equipment. A typical record is illustrated in Fig. 1.

Previous differential thermal analytical studies have been carried out with magnesia-packed furnaces, but the

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[2] The authors wish to acknowledge suggestions by Mr. Coutland Pearsall on furnace design, and the cooperation of Mr. John Solo in construction of the furnace.