a prismatic crystal (Jumilla) and (b) a tabular crystal (Sulzbachtal), with their respective growth patterns.

As one can scarcely imagine an influence of the edges of the prism faces upon the growth fronts and imposing their outline to them, one must rather accept the contrary, that is, that crystal habit results from the shape of the growth spirals. Agents changing the relative growth-rates of growth fronts would influence crystal habit in such a way that edges will be developed perpendicular to directions of minima for growth velocities on the close-packed faces.

These observations further support the idea that habit modification by foreign substances would proceed rather by selective adsorption along growth fronts than by adsorption on certain crystal planes.

I wish to thank Prof. W. Dekeyser for his kind interest, the C.N.B.C.P.M. for support, and the Mineralogy Department of Koninklijk Belgisch Instituut voor Natuurwetenschappen (Brussels) for the loan of specimens.

S. AMELINCKX

Geologisch Instituut,
Laboratorium voor Kristalkunde,
University of Ghent,
Ghent.
July 18.

¹ Burton, Cabrera and Frank, *Phil. Trans. Roy. Soc., A*, **243**, 299 (1951).
² Amelinckx, S., *Nature*, **169**, 841 (1952).

Determination of the Pore-Size Distribution in Porous Metal Bodies

THE pore-size distribution of a porous metal body can be defined in three ways, namely, those given by the expressions $\partial V/\partial r$, $\partial \alpha/\partial r$ and $\partial N/\partial r$, where r is the 'radius' of the pore and ∂V , $\partial \alpha$ and ∂N respectively represent volume, permeability and number of pores associated with the pore-size interval r to $(r + \partial r)$. $\partial V/\partial r$ may be determined by observing the capillary rise of a liquid in a narrow strip of the material. If h is the capillary rise, a simple equation relates h to r , and $\partial V/\partial h$ is readily determined by breaking the strip at h_1 , h_2 , h_3 . . . and weighing the pieces to ascertain the values of V corresponding to the sections $(h_1 - 0)$, $(h_2 - h_1)$, $(h_3 - h_2)$. . .

If the perimeter of a section through a pore is P and the area of the section A , then equating forces acting on the surface of the liquid that has risen in the pore and neglecting the weight of the liquid above the meniscus, we may write:

$$P\sigma\cos\beta = Ah\delta g,$$

where σ is the liquid-air interfacial tension and β is the angle of contact between the liquid of density δ and the material from which the porous body is made. The value for A/P thus determined is equal to $r/2$ if the pores are circular in section; it is therefore implied in the sequel that the 'radius' of a pore (r) is that calculated as $2A/P$. This is in error inasmuch as the pores are not circular in section.

The smallest pore that can be determined by a capillary rise method has a 'radius' given by

$$r = \frac{2\sigma\cos\beta}{X},$$

where X is the atmospheric pressure. In order to extend the determination of the distribution of pore size to the very smallest pores, it is therefore necessary to use a liquid of very low surface tension to fill them.

* (A) and (B), pores filled with water; (C), pores filled with acetanilide

The values of h corresponding to the values of r (5–250 μ) which commonly occur in metallic filter materials are inconveniently large if water is used as the pore-filling liquid and rises against the force of gravity.

Increasing g by means of a centrifuge enables a determination of the distribution of the pore-sizes from 7 to 250 μ (which contain more than 99 per cent of the total pore volume) to be made on a piece of porous stainless steel 10 cm. $\times$ 1 cm. $\times$ 0.3 cm. The accompanying graph shows three typical pore-size distribution curves of samples of porous stainless-steel filter materials. Curves A and B were determined by centrifuging the porous sample in the presence of a slight excess of water, which was thus distributed in the pores under the mutually opposing forces of surface tension and increased gravity. An addition of liquid oxygen by means of a specially designed funnel was made, to freeze the water in the pores while the centrifuge was still spinning. The specimen was then broken at the points h_1 , h_2 , h_3 . . . into previously weighed weighing bottles before the ice melted. After weighing, the water was removed from the broken pieces in an oven at 110° C. and the broken pieces reweighed to determine their water contents.

Organic compounds may also be used as pore-filling liquids. As an example of their use, the results plotted as curve C were determined with acetanilide. A small furnace was mounted in one of the centrifuge tubes, slip rings providing the means of carrying the heating current to it and the thermal E.M.F. from it to a pyrometer. Molten acetanilide (melting point 114° C.) was allowed to distribute itself through the pores of the metallic compact under the forces of its surface tension and the increased g due to centrifugal forces. On being allowed to cool, it solidified in position and its distribution through the metal could be determined in a manner similar to that used for the ice-filled porous metal.

A full account of this work is being prepared for publication elsewhere.

I wish to acknowledge the help of Mr. K. Simpson, who did part of the experimental work; and to thank Mr. D. A. Oliver, director of research to the B.S.A. Group of Companies, for his encouragement and support of this work.

P. R. MARSHALL

The B.S.A. Group Research Centre,
Greystones Hall,
Sheffield 11.
May 14.