

In particular, the variation of peripheral speed and power intensity with cell size needs resolving. Once the relationships become established, they will provide a frame of reference for investigating the remaining operating variables. This should give an insight, for example, into the factors responsible for differences in the flotation-rate of the same material treated in different cells, both with regard to the size of cells and their design. In passing, it may be noted that this general correlation method should be applicable to the conditioning operation, which is likely to present fewer problems.

This possible correlation is brought to attention in the hope that adequate commercial data with which to establish this or some other correlation will now become available.

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<sup>1</sup> Arbiter, N., *Eng. and Mining J.*, **156**, 63 (1955).

<sup>2</sup> Harris, C. C., *Nature*, **183**, 530; **184**, 716 (1959).

<sup>3</sup> Arbiter, N., *Trans. Amer. Inst. Min. Eng.*, **190**, 791 (1951).

<sup>4</sup> Horst, W. E., *Trans. Amer. Inst. Min. Eng.*, **211** (*Min. Eng.*), **10**, 1182 (1958).

<sup>5</sup> Rose, E. N., *Trans. Amer. Inst. Min. Eng.*, **169**, 394 (1946).

<sup>6</sup> Perry, J. H., ed., *Chemical Engineers Handbook* (McGraw-Hill, New York, 1950).

<sup>7</sup> Brown, G. G., et al., *Unit Operations* (John Wiley, New York, 1950).

<sup>8</sup> Coulson, J. M., and Richardson, J. F., *Chemical Engineering* (Pergamon Press, London, 1955).

<sup>9</sup> McCabe, W. L., and Smith, J. C., *Unit Operations of Chemical Engineering* (McGraw-Hill, New York, 1956).

<sup>10</sup> Johnstone, R. E., and Thring, M. W., *Pilot Plants, Models, and Scale-up Methods in Chemical Engineering* (McGraw-Hill, New York, 1957).

<sup>11</sup> Faust, A. S., et al., *Principles of Unit Operations* (John Wiley, New York, 1960).

<sup>12</sup> Ward, S. G., *J. Oil Colour Chem. Assoc.*, **38**, 9 (1955).

## CHEMISTRY

### Nomenclature of Silica

FOR many years the term 'fused quartz' has been used for describing vitreous silica prepared by the fusion of crushed quartz crystals. In some quarters the term 'vitreous silica' has been reserved for material made from an acid-washed sand, usually containing larger amounts of impurities. Unfortunately, the term 'fused quartz' is often abbreviated to 'quartz' in the later pages of a publication, and sometimes even in the title. A quick glance at *Chemical Abstracts* subject index for 1956 revealed four abstracts dealing with "quartz", where it was obvious that vitreous silica was meant<sup>1</sup>. The electrophoresis of "quartz particles in a quartz cell" is mentioned in one abstract. It is highly unlikely that the electrophoresis cell was of crystalline quartz; it was presumably vitreous silica. The question remains, were the particles also of vitreous silica? A recent example of the misnaming of silica is a paper dealing with vitreous silica and probably cristobalite<sup>2</sup> and headed "Whisker growth from quartz". It contains the sentence "The quartz substrate . . . had a skin of devitrified quartz . . .".

The term 'amorphous silica' is not used in any more consistent fashion. In general, it denotes an artificial silica filler or a naturally occurring material such as opal or diatomite. The artificial silica powder, of sub-microscopic particle size and correspondingly high specific surface, may have been prepared by one of

two types of process. A material made from an aqueous soil by drying will readily take up moisture; the particles will be porous. Silica powders prepared by a condensation of SiO<sub>2</sub> or SiO from the vapour phase will be less hygroscopic. A material such as 'Fransil', consisting of tiny spheres of silica glass, might be better classified as a fine vitreous silica. Diatomite is comparatively coarse, but extremely porous. If it has been calcined, it will have been partly converted to cristobalite or even tridymite, both toxic materials.

The chemical and biological properties of the various forms of silica depend markedly on the polymorphic form (vitreous silica, cristobalite, tridymite, quartz, coesite), particle size, porosity, and thermal history of the surface, even when the material is very pure. The examples cited show that there is a need for greater care and detail in the description of various forms of silica by means of such terms.

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<sup>1</sup> *Chem. Abstr.*, **50**, 6103h, 8285e, 15172c, 15173i (1956).

<sup>2</sup> Jaccodine, R. J., and Kline, R. K., *Nature*, **189**, 298 (1961).

### Determination of Hydrogen in Gaseous Mixtures by Gas-Chromatography

IN the analysis of gaseous mixtures by gas-solid chromatography using hot-wire or thermistor detectors, it is usual to reduce the signal to the recorder, when necessary, by an attenuating system in the form of a potentiometric chain so that only a known proportion of the signal is applied to the recorder. This method results in the main components of a mixture being measured less accurately than impurities or components of small concentration. This is particularly true when hydrogen is a main component, as it has a thermal conductivity seven or eight times as great as most other gases or vapours, necessitating a large measure of attenuation to keep its peak on the chromatographic chart.

The gaseous mixtures commonly analysed in this Laboratory contain about 40 per cent hydrogen, and the volume of gas necessary to achieve sensible peak measurements for the nitrogen present results in a hydrogen signal from a katharometer bridge of about 115 mV. In the past this signal has been attenuated to about 2.3 mV. to allow the peak to be measured on the 3-mV. potentiometric recorder used. Thus 40 per cent of hydrogen is represented by 2.3 mV. or a deflexion of 214.5 mm., and an error of 1 mm. in measurement leads to an inaccuracy of about 0.5 per cent in the bridge signal.

It was therefore decided to reduce the signal to the recorder by applying an accurately determined e.m.f. in opposition to the output from the katharometer bridge. The conventional apparatus used had recorder sensitivities of 3, 5, 15, 25, 50 and 150 mV. for full-scale deflexion. Of these the 15 mV. range was selected as being the most practical one to use. On this scale, for a gas containing 40 per cent hydrogen an effective back e.m.f. of 105 mV. is required to keep the signal to a reasonable position on the chromatographic chart. This is achieved by applying an e.m.f. of 21 mV. (that is, 105 × 3/15 mV.) across the potentiometric chain in opposition to the signal to the recorder. The recorder then registers a peak from a signal of 10 mV., giving a deflexion of 186.4