

The Structure of Vitreous Silica

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The appearance of sharp diffraction lines in electron-diffraction patterns of vitreous silica has been interpreted as evidence that the material is crystalline. The method of sample preparation was such as to cause surface devitrification. The conclusions are, therefore, unwarranted.

THE writer's attention has recently been called¹ to publications of Shishacow^{2,3} reporting the results of electron diffraction by vitreous silica. Shishacow found sharp diffraction lines which correspond to calculated spacings which would be expected from tetragonal cristobalite crystallites of the order of 15–20Å in average dimension. (His axial lengths and ratio do not agree with the accepted values, the differences being attributed to strains.) Shishacow concluded that the appearance of sharp lines in electron-diffraction patterns, in contrast to the diffuse bands found in x-ray studies, was due to the higher resolving power of electrons. He thus implied that vitreous silica consists of small crystallites.

A simpler explanation, and one which does not require the postulate of long-range order in vitreous silica, can be formulated by considering the method of sample preparation followed by Shishacow. He prepared

his material by careful grinding, followed by air flotation. The material thus collected consisted of particles of the order of less than a tenth of a micron in diameter. Significantly, the surface had been highly worked during the grinding process. The degree of working and, in addition, the local temperatures involved should have been enough to cause devitrification of the glass to cristobalite, at least on the surface. Since electron diffraction is essentially a surface phenomenon, the cristobalite pattern would have been predominant.

It would appear that the results reported by Shishacow do not support the thesis that vitreous silica consists of minute crystallites. Further, Maxwell and Mosley⁴ obtained electron-diffraction patterns by transmission through very thin films of vitreous silica formed by blowing without abrasion. Their patterns consisted principally of diffuse bands. Some portions of sharp lines were present, but these might have been due to impurities or surface devitrification.

* Operated for the U. S. Atomic Energy Commission by the General Electric Company.

¹ R. Hillig (private communication).

² N. A. Shishacow, *Nature* **136**, 514 (1935).

³ N. A. Shishacow, *J. Tech. Phys. (U.S.S.R.)* **5**, 1834 (1935).

⁴ L. R. Maxwell and V. M. Mosley, *Phys. Rev.* **47**, 330 (1935).