Surface B–OH Groups on Porous Vycor Glass

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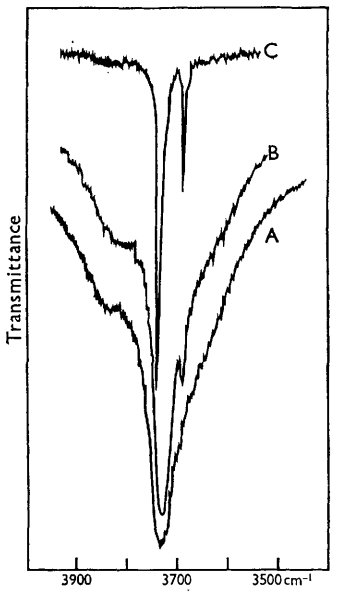

FIGURE. *Infrared Spectrum of Porous Glass*

Porous Vycor glass (Corning 7930) was degassed for 80 hours at 500° prior to a 25-hour treatment at 600° (Spectrum A) and 8 hours at 650° (Spectrum B); or was degassed for 24 hours at 750° and 92 hours at 825° (Spectrum C). Spectra were recorded with a Perkin–Elmer Model 521 spectrometer. The spectra are displaced and ordinates are arbitrary.

THERE have been numerous studies of the surface of porous Vycor glass using infrared-spectroscopic techniques, some with particular emphasis on the hydroxyl groups on the surface.[1] There is a general agreement in that only silanol groups have been reported, isolated OH groups producing a band somewhere near 3750 cm.$^{-1}$, similar to that of spectrum A. We have, however, found the situation to be more complex.

On dehydrating porous glass at higher temperatures, for longer times, and under better vacuum conditions than had previously been used, as well as with an instrument capable of greater resolution, the hydroxyl band decreased in intensity and was resolved into other bands. Spectrum B shows an intermediate stage. Of particular interest is the sharp band at 3700 cm.$^{-1}$ Various experiments of exchange with deuterium, water adsorption, fluoridation, and the like, which will be reported in detail at a later date, indicate that the 3700 cm.$^{-1}$ band is caused by OH groups on boron atoms on the glass surface. Particularly significant were experiments in which silica and porous glass were treated with boric acid and the sharp 3700 cm.$^{-1}$ band was produced or enhanced. The presence of at least two surface OH groups, rather than one type, must be taken into consideration when dealing with gas adsorption or catalysis.

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[1] M. Folman and D. J. C. Yates, *Trans. Faraday Soc.*, 1958, **54**, 1684; A. V. Kiselev and V. I. Lygin, *Proc. Second Internat. Congress Surface Activity*, 1957, 2,204; L. H. Little and M. V. Mathieu, *Actes, Congr. Internat. Catalyse*, 2e, Paris, 1960, 1,771; T. H. Elmer, I. D. Chapman, and M. E. Nordberg, *J. Phys. Chem.*, 1962, **66**, 1517.