

cessation of hydrogen adsorption and disappearance of the last traces of colour corresponds to the end point of a titration. From the sample weight, dose and hydrogen adsorbed, one can follow the production of colour centres and calculate their yield. Such an experiment has shown a yield on freshly degassed gels of 1 centre per 100 eV. absorbed, dropping gradually to a value of 0.1 centre per 100 eV. with further irradiation as more hydrogen is absorbed. At this point approximately 3×10^{18} centres/gm. have been introduced into the catalyst.

Qualitatively, both silica-alumina and alumina catalysts show the same phenomenon of coloration and decolorization with adsorption. Before irradiation, a degassed gamma alumina is fairly white and adsorbs no hydrogen. After irradiation it is faintly cream-coloured and slowly adsorbs hydrogen. The adsorption is too sluggish to follow conveniently but decolorization by excess hydrogen is complete in 1 hr. The change in appearance compared with that of silica gel is very slight. 'Houdry S 46', a silica-alumina cracking catalyst (12½ per cent aluminium oxide) after degassing at 50° C. is off-white and adsorbs small (~ 0.03 micromole/gm.) amounts of hydrogen. After a long (5×10^{20} eV./gm.) irradiation, the sample has a marked tawny appearance with magenta overtones, and adsorbs 1 micromole of hydrogen per gm., gradually losing its colour as it does so.

A plausible explanation of these phenomena is that the colour centres are positive holes associated with oxygen excess in the silica, and that these holes are neutralized by interaction with electrons from the bleaching gas. However, the initial yield of adsorption sites per unit dose obtained in this work is greater than that of catalytic exchange sites determined previously² by a factor of 10^8 . Hence, even though the effect of irradiation on hydrogen adsorption is clearly demonstrated, the connexion between the coloration-bleaching phenomena and the irradiation enhancement of silica catalysts is not yet clear.

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Ultrasonic Absorption in Acetic Acid at 450 kc./s. by the Calorimetric Method

CALORIMETRIC measurements based on thermo-sonic principles have successfully been used^{1,2} for the determination of ultrasonic absorption in liquids at frequencies of 5 Mc./s. and above. Recently it has been possible to extend this method to measurements in acetic acid at 450 kc./s.

At frequencies of this order, the divergence of the beam is pronounced, and when the cell is moved away from the course the whole of the sound beam does not enter the cell; further, for the complete absorption of the beam at these low frequencies a long column of

liquid is necessary, which increases the thermal capacity of the system considerably and results in a comparatively smaller rise of temperature.

These defects have been overcome by using a smaller area of sound emitter compared to the mouth of the absorbing cell; and by employing a spherical double-walled glass cell with a plane section for the entrance of the beam. The sound beam on entering the cell undergoes multiple reflexions at its inner surface until it is completely absorbed.

The experiment was carried out on acetic acid. In a typical set of observations a rise in temperature of 0.5° C. and 2.2° C. was observed in two positions of the crystal in 30 minutes. The separation between these positions was 3.5 cm.

The value of α/v^2 for acetic acid at 450 kc./s. and 30° C. was found to be about $90,000 \times 10^{-17} \text{ cm.}^{-1} \text{ sec.}^2$ being an average of a large set of readings with a variation of ± 10 per cent. This agrees with the value of about $80,000 \times 10^{-17} \text{ cm.}^{-1} \text{ sec.}^2$ at 500 kc./s. obtained by Lamb and Pinkerton³. Lamb, Andreae, and Bird⁴, however, reported a value of $175,000 \text{ cm.}^{-1} \text{ sec.}^2$ below 2 Mc./sec. at 17.5° C.

An attempt was made to use this method for measurements in benzene and carbon disulphide, but it was found that owing to the comparatively small absorption in these liquids the difference in the rise of temperature at the two positions of observation was either negligible or very small, and, in the latter case, comparable to the necessary corrections. In view of this limitation the method reported here is applicable only to liquids having an absorption coefficient not lower than $10,000 \times 10^{-17} \text{ cm.}^{-1} \text{ sec.}^2$ at these low frequencies.

Further work on this problem is in progress.

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MINERALOGY

Revised Equilibrium Diagram for the System $\text{Al}_2\text{O}_3\text{-SiO}_2$

THE most important system in present-day high-temperature technology is $\text{Al}_2\text{O}_3\text{-SiO}_2$. The accepted equilibrium diagram for this system was determined in a classic investigation by Bowen and Greig¹; but during the last few years several workers have questioned its correctness²⁻⁶. The data offered in criticism have not, however, been unequivocal themselves. We summarize briefly here the data from some 700 runs in a nearly two-year re-examination of the $\text{Al}_2\text{O}_3\text{-SiO}_2\text{-H}_2\text{O}$ system by standard 'quenching' methods of studying silicate phase equilibria.

The starting mixtures were made mainly from hydrated aluminium nitrate and silica sol of very high purity for hydrothermal runs, and from high purity silica glass and α -alumina for 'dry' runs. The mixtures were all run in hermetically sealed noble metal containers of 80Pt-20Rh and 60Pt-40Rh in a gas-oxygen quenching furnace with zirconia refractories, capable of reaching 1900° C. Temperatures were read