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Summary

Seven critical potentials of hydrogen in the presence of nickel catalyst have been determined. Four of these have been attributed to the atom, two to the molecule and one to the nickel-hydrogen complex. The results are considered to indicate the presence of atomic hydrogen in the system, hydrogen-nickel catalyst.

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NOTE

The Bifilar Quartz Fiber Manometer.—In a recent article,[1] I described a form of bifilar quartz fiber micromanometer suitable for adsorption measurements at low pressures. The instrument was separated from the rest of the apparatus by a gold-foil trap, with the object of keeping out mercury vapor, and was cooled with snow in order to prevent errors due to temperature variations. In working with this manometer at still lower pressures, it soon became apparent that the gold trap was quite ineffective. When a plain trap was substituted, and cooled to —25°, the constant "*a*," (reciprocal of time in which the amplitude falls to $1/e$ times its original value in a perfect vacuum) fell from 0.0006 per second to 0.0002 per second, in the case of Gage "B." Further cooling the trap did not further diminish the damping. Variations in the temperature of the gage did not alter the damping. The great diminution of damping previously found to be caused by cooling the gage must therefore have been due simply to the removal of mercury vapor by condensation on the cold walls.

This error in the evaluation of "*a*" cannot have affected the validity of the conclusions drawn in the previous paper, since it merely added a constant quantity to C in all readings; moreover, it is entirely negligible at the higher pressures with which the paper was mainly concerned.

When the gage is used in the lower range, its temperature need not be known. The resistance which a fiber of unit length and velocity experiences in moving through a gas at low pressure is, by Haber and Kerschbaum's[2] Equation 13, $K = \frac{4P\sqrt{M}}{\sqrt{3RT}} D + Z$, where D is the diameter of the fiber, and Z its intrinsic viscous resistance. If, now, such a fiber is calibrated against a Macleod gage at the same temperature, and the temperature of the quartz gage is then changed (the pressure in the Macleod

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[1] Coolidge, THIS JOURNAL, **45,** 1637 (1923).

[2] *Z. Elektrochem.*, **20,** 297 (1914).

gage remaining constant) that in the quartz gage will vary, as a result of thermal transpiration, being always proportional to the square root of the absolute temperature. Since $P/\sqrt{T}$ is constant, so must be K, except for any temperature variation in Z; this is at most very small, and may ordinarily be neglected as constituting a correction to a correction. Since K determines the gage reading, the latter will be independent of the temperature of the gage, which need not be controlled. If, after calibration, the gage is used for measuring pressures in systems at different temperatures, a correction for thermal transpiration must be made; however, the temperature difference which must be used in calculating the correction is not that between the system and the quartz gage, but that between the temperature of the system and that of the Macleod gage by which the quartz gage was calibrated.

In the upper range of pressures, there must be a small temperature coefficient caused by the rising viscosity of the gas. A calibration curve obtained at one temperature can be converted over to another temperature by displacement along the asymptote, by an amount determined by the change in the viscosity of the gas, in exactly the same way that it can be converted for use with another gas, by using the relative viscosities of the two gases. Between 0° and 20° the change is for most gases about 10%. In the work described on page 596, the pressure never became high enough to make this correction necessary. The temperature of the gage was therefore neglected, the trap kept always at —25°, and the gage read by the aid of the calibration curve obtained at 0°, suitably altered by the substitution of the new constant "a."

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