The Infrared Absorption Spectrum of HDS and D2S

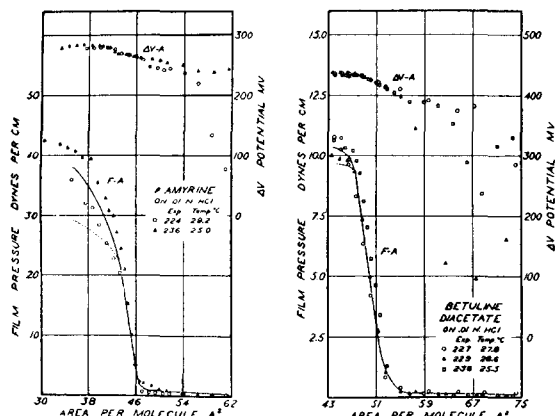Alvin H. Nielsen and Harald H. Nielsen

FIG. 3. Film pressures and potentials for vitamin E and betuline diacetate.

film as given by investigators in England are not dipole moments at all, but only values of $m/4\pi$. In units of 10^{-18} e.s.u. per molecule the maximum values of m are approximately 2.2 for betuline, 2.1 for amyrine, 6.0 for oleanic acid, 6.8 for sumaresinolic acid, 7.5 for betuline diaceto and 7.8 for siaresinolic acid. These values are much higher than those given by films of fatty acids, alcohols, etc., which lie in general between 2 and 3 when the number of carbon atoms is between 12 and 18.

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The Infrared Absorption Spectrum of HDS and D_2S

The infrared absorption spectrum of the molecules HDS and D_2S has been investigated between 1.5μ and 12.0μ, by using a prism spectrometer of the Wadsworth type, with the result that several vibration-rotation bands characteristic of each were found. The two samples of gas studied were prepared with D_2O of two different purities. The HDS was made by dropping 55 percent D_2O on chemically pure aluminum sulfide, and the D_2S was made by dropping 99.2 percent D_2O on aluminum sulfide, in each case being very careful to trap out any "heavy water" vapor. The purity of the samples was thus assured. The cell of HDS contained, of course, some H_2S, and some D_2S also, and all the previously known bands of H_2S [1] were found in its spectrum in addition to the new ones. The purity of the D_2S could not be doubted and the bands found were attributed to it alone.

The positions of the bands found in D_2S are as follows: 3.65μ, 4.55μ, and 10.8μ. Two of these regions have been studied with a prism-grating spectrometer with the result that their rotational structure has been very completely resolved. The band at 3.65μ appears to be of the P, Q, R type with a very broad and partially resolved Q branch.

The band at 10.8μ has also been resolved, but it does not have a Q branch and is probably more nearly the doublet type.

In HDS none of the bands have as yet been studied with the grating and resolved. The positions of the bands given by the prism data are: 2.1μ, 3.15μ, 4.1μ, 9.0μ. By combining these new bands with the ones already known in H_2S in a table it can be seen how the bands corresponding in HDS, and D_2S are shifted toward longer wave-lengths in the anticipated manner.

TABLE I.

H_2S	HDS	D_2S
1.9μ	2.1μ	—
2.65	3.15	3.65μ
3.70	4.1	4.55
7.9	9.0	10.8

The grating measurements on the remaining bands have been begun and will be reported in this journal in the near future. We wish to express our appreciation to Professor H. L. Johnston of the Chemistry Department of Ohio State University, for his kind cooperation in furnishing us with the quantities of "heavy water" used in making the samples of gas.

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[1] Rollefsen, Phys. Rev. **34**, 604 (1929); Nielsen, ibid. **37**, 727 (1931).
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On Some Gas-Kinetic Properties of Light and Heavy Hydrogen

The knowledge of certain gas-kinetic quantities as the coefficients of viscosity, of thermal conductivity and diffusion which are mutually interrelated has become of considerable importance, particularly since their measurement has been used for the determination of the concentration of the *ortho* and *para* modifications in the case of the two hydrogens. We have therefore closely investigated the influence of the statistical weights of the various molecules on these coefficients. It thereby turned out for example, that in the neighborhood of 70°K, the coefficient of viscosity of pure parahydrogen should be approximately six percent smaller than that of ordinary hydrogen. This difference decreases at lower and higher temperatures, but is expected to increase again when the temperature becomes extremely low. A corresponding effect for deuterium should be vanishingly small. The calculations have been made on the basis of the rigid sphere model and the numbers given might therefore still depend on the actual force of interaction between the molecules. We shall later on report in more detail on the application of the theory to other gas-kinetic quantities and to other gases.

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