

Spectra of Lipoid Fractions from Human NonCancerous and Cancerous Tissue

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Citation: [The Journal of Chemical Physics](#) **10**, 145 (1942); doi: 10.1063/1.1723671

View online: <http://dx.doi.org/10.1063/1.1723671>

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Letters to the Editor

Effects of Heat Capacity Lag in Gas Dynamics

ARTHUR KANTROWITZ

National Advisory Committee for Aeronautics, Langley Field, Virginia.

December 8, 1941

RECENT measurements of the velocity and absorption of sound have shown that gases absorb their vibrational heat content exponentially with a measurable relaxation time. The object of this letter is to point out, first, the significance of this for gas dynamics and, secondly, that methods of gas dynamics provide simple and flexible means of measuring heat capacity lag.

In the flow of gases, compressions and expansions occur in which the temperature of the gas changes. It has usually been assumed that these pressure and temperature changes occur reversibly in actual gases (apart from the effects of viscosity, heat conduction, and compression shocks). However, in problems involving the flow of a gas with vibrational heat capacity, one would expect that the vibrational heat energy would lag behind translational energy changes in the gas. This lag would lead to dissipation of energy in the gas in the same way as it produces a high absorption of sound.

Consider the compression at the nose of a total head tube in a uniform stream as an example. Let us first consider the case where the tube is very small, i.e., small enough so that the gas is brought to rest (or more precisely, loses the greatest part of its kinetic energy) in a time short compared with the relaxation time of the gas. In this case the vibrational energy is unchanged during the compression, i.e., effectively the gas has a reduced heat capacity during the compression. This results in an impact pressure *lower* (by several percent for CO₂, for example) than that which would have been obtained in a compression slow enough so that the vibrational energy would not lag appreciably behind the translational energy of the molecules.

In the more general case some of the changes in temperature occur in times comparable with the relaxation time of the gas. An approximate solution of this problem can be found by calculating the excess vibrational energy H in a fluid particle at all times during its passage along a streamline, assuming the flow pattern to be unaffected by the heat capacity lag. In this case H at any point along a streamline can be expressed as an integral involving the time history of the fluid particle up to that point. The change in entropy of the fluid particle can then be found from an integral of a function of H along a streamline. In this way it is, in principle, possible to find the total entropy change and thus the energy dissipation in a general flow problem. For example, the pressure at the nose of an impact tube in the case where the relaxation time is comparable to the time of compression at the nose can be obtained since the energy, entropy, and velocity at the nose are now known.

An apparatus with which one can readily detect these energy dissipations consists of a small chamber with arrangements to permit gas to enter the chamber and

escape through a $\frac{1}{8}$ -inch diameter faired orifice in a $\frac{1}{2}$ -inch plate. A small glass impact tube is placed axially in the center of the mouth of the orifice, and the difference in pressure between the impact tube and the chamber is measured. This pressure difference is nearly zero for gases without vibrational heat capacity. The total head defects anticipated were easily found for air and CO₂ and agreed with expectations from sonic experiments.

Gas dynamical methods appear in principle capable of measuring relaxation times as short as 10^{-8} second. It is intended to develop these methods and to report them in a later paper.

Spectra of Lipoid Fractions from Human Non-Cancerous and Cancerous Tissue

H. S. PENN

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December 20, 1941

THE object of this communication is to report on the spectra of fluorescent lipoid fractions obtained from human non-cancerous and cancerous livers, and cancerous tissue. All tissues were treated under identical conditions, and a report of the preparation of the lipoids will be given elsewhere. The fluorescence was excited with the light of a mercury arc. The non-cancerous lipoid fractions showed much weaker fluorescence than did the cancerous fractions under identical experimental conditions. Although the fluorescence spectrum of the non-cancerous fractions lies in the same general region as that of the cancerous fractions, we are not yet prepared to say that the two spectra are identical. The strong and easily identifiable fluorescence of the cancerous fraction lies on the long wave-length side of the 4047-4077 pair and with increasing deproteinization

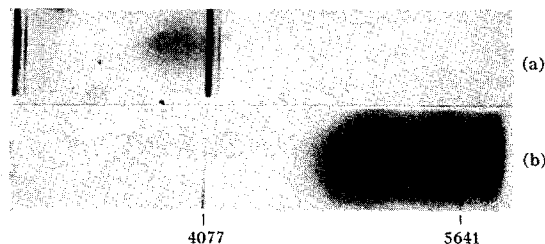


FIG. 1. Fluorescence of (a) non-cancerous, (b) cancerous tissue, partially deproteinized.

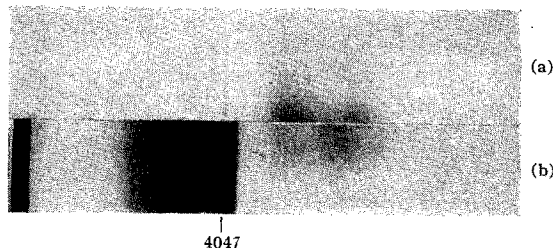


FIG. 2. (a) Fluorescence of methyl cholanthrene. (b) Fluorescence of cancerous tissue, maximum deproteinization.

approaches the characteristic fluorescence spectrum of methyl cholanthrene. The best sample indicates an identity between the fluorescence spectra of methyl cholanthrene and the cancerous fraction. The possibility that many forms of cancer may originate in the metabolic production of methyl cholanthrene or related substances from the bile acids, or perhaps from the sterol or sex hormones of the body, has been mentioned elsewhere. The spectrographic work has been done with the aid of Dr. S. M. Rubens and Professor J. Kaplan of the University of California at Los Angeles.

The Low Frequency Fundamental Band of Ethane at 12μ

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December 29, 1941

IN preparing for a study, now under way, of the infra-red spectra of deuterium bearing ethanes we have re-examined the low frequency fundamental absorption band of C_2H_6 . This band was first resolved by Levin and Meyer,¹ with a spectrometer somewhat less effective than the best now available. They showed that it is of the degenerate perpendicular type, consisting of a family of Q branches spaced at intervals of approximately 2.6 cm^{-1} . The significance of this and other details of the ethane spectrum has been discussed more recently by Crawford, Avery, and Linnett.²

The pattern of this band as obtained with our present instrument is shown in Fig. 1, and the wave numbers

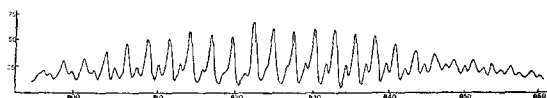


FIG. 1. The 12μ band of ethane; percent absorption vs. wave number.

(reduced to vacuum) for the various maxima are listed in Table I. These measurements reveal two features worthy of remark. (1) The spin effect, which slightly accentuates every third line, is clearly revealed. Since the band center must lie one-half interval toward lower frequencies from the strongest line, its position may be definitely fixed. We

TABLE I. Observed line positions in wave numbers reduced to vacuum.

Major peaks	Minor peaks	Major peaks	Minor peaks
859.54	857.72	822.20	
856.70	855.23	819.52	
853.95	852.76	816.79	815.78
851.34	850.08	814.22	812.96
848.59	847.58	811.60	810.35
846.06	844.60	808.94	807.60
843.36	842.06	806.39	805.00
840.75	839.50	803.84	802.36
838.08	836.81	801.24	798.98
835.39	834.12	798.69	797.18
832.67	831.53	796.39	
830.05	829.02		
827.40			
824.76			

obtain for it the value 820.82 cm^{-1} . The high frequency side of the band is the more intense because of lower initial K values. (2) Approximately midway between the major peaks a series of minor absorption maxima are observed. These appear to be relatively stronger near both limits of the band, and less intense in the neighborhood of the center, suggesting two subsidiary transitions. They probably arise from the change $1 \rightarrow 2$ in the same vibrational quantum number for which the transition $0 \rightarrow 1$ yields the principal band. The first excited state involves an internal angular momentum which, for the upper transitions, may either increase or decrease, with resulting bands at frequencies above and below that of the fundamental. From the present measurements we are not able to determine the centers for these low intensity bands.

* Now at Colorado School of Mines.

¹ A. Levin and C. F. Meyer, *J. Opt. Soc. Am. and Rev. Sci. Inst.* **16**, 137 (1928).

² B. L. Crawford, W. H. Avery and J. W. Linnett, *J. Chem. Phys.* **6**, 682 (1938).

Erratum: Chain Length and Chain-Ending Processes in Acetaldehyde Decomposition

(*J. Chem. Phys.* **7**, 1080 (1939))

MILTON BURTON, H. AUSTIN TAYLOR AND THOMAS W. DAVIS
New York University, University Heights, New York, New York
January 3, 1942

In a paper under the above title,¹ the chain lengths in the azomethane-induced decomposition and in the photolysis of acetaldehyde at equal rates of free radical production and equal aldehyde concentrations were calculated from the available data. It has been called to our attention by Professor O. K. Rice that the calculation for the induced decomposition is in error. The chain length per free radical should have the value ~ 220 . Comparison of this value with that for the photolysis given by us as 844 vitiates our conclusions drawn in the paper cited relative to the chain-ending processes and would necessitate a new analysis of the possible reactions involved. It is our understanding that Professor Rice plans to discuss such possibilities in a forthcoming paper.

¹ *J. Chem. Phys.* **7**, 1080 (1939).

Erratum: Ethylene-Ethane and Propylene-Propane Equilibria

(*J. Chem. Phys.* **10**, 78 (1942))

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THROUGH an error Dr. Nickle's name was omitted from this Letter to the Editor. The authors should have been listed as above.