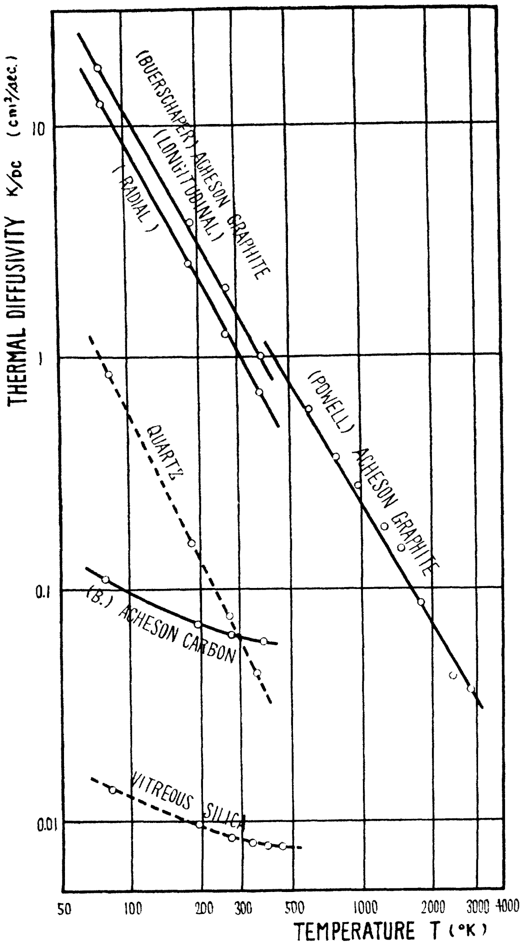

FIG. 2. Variation with temperature of the thermal diffusivities of carbon and silica.

for the impurity scattering. This result may be attributed to the dependence of the energy on the wave number vector, which is linear near the Fermi surface, and to the proportionality of the effective mass to temperature. On the other hand, the electrical conductivity of amorphous carbon, such as pitch coke which has been heated at low temperatures, was found to be expressed approximately by $\sigma = A\exp(-E/kT)$, where A is a constant. The activation energy E varied from about 0.10 ev to 0.03 ev for specimens heated between 520°C and 715°C. Films of organic substance remaining at the crystallite boundaries are probably playing an important role in these cases.

It has been noted that there is a remarkable difference between the thermal conductivity of graphite and that of amorphous carbon. This can be explained by the difference of the mean free paths of thermal elastic waves in the two media. The thermal conductivity K is expressed in terms of the propagation velocity u and the mean free path l as $K/DC = lu/3$, where D is the density and C is the specific heat. Values of the thermal diffusivity are plotted in Fig. 2 against temperature for artificial graphite and amorphous carbon using the experimental data obtained by several investigators.[3,4] For comparison, curves for quartz and vitreous silica are included there also. It is evident from this figure that there is a close resemblance between these two sets of curves. Therefore, the mean free path is considered to be determined by mutual collisions in the case of graphite and by the crystallite boundaries in the case of amorphous carbon, just as for the two allotropic forms of silica.[5] In fact, the mean free path in amorphous carbon was estimated to be the order of 50A, which may be compared with the crystallite size of several tens of angstroms measured by x-ray methods for many kinds of amorphous carbon.

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Some Molecular Dipole Moments Determined by Microwave Spectroscopy

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(Received February 9, 1951)

A STARK modulation type absorption cell has been constructed in which the electrode spacing is known to ±0.2 percent. The dipole moments of several compounds have been measured and these are listed in Table I.

TABLE I. Dipole moments from Stark effect measurements.

Formula	Compound	$\mu \times 10^{18}$ (esu)	Transition observed
OCS	Carbonyl sulfide	0.712 ± 0.004	$J_{1\rightarrow 2}$
HNCO	Isocyanic acid	1.592 ± 0.010	$0_{0,0} \rightarrow 1_{0,1}$
H_2CO	Formaldehyde	2.339 ± 0.013[a]	$9_{2,8} \rightarrow 9_{2,7}$
		2.340 ± 0.019	$3_{1,3} \rightarrow 3_{1,2}$
CHF_3	Fluoroform	1.645 ± 0.009	$J_{0\rightarrow 1}$

[a] The absolute accuracy of the value 2.17±0.02 Debye units, reported by J. K. Bragg and A. H. Sharbaugh [Phys. Rev. **75**, 1774 (1949)], was in error because of an irregularly spaced Stark electrode. Use of the new precision cell precludes this possibility in the present work.

The experimental error quoted is the sum of the precision error of the particular measurement and the systematic errors. These are: (1) Electrode spacing, ±0.2 percent. (2) Voltage divider, ±0.06 percent, and (3) Error in the measurement of the displacement of the absorption line, under the applied field, ±0.1 percent, due to uncertainty in the frequency of the undisplaced line. This error can be neglected in the measurements for OCS, since the dipole moment was calculated from Stark components which moved to higher and lower frequencies.

A reduction of 0.7 percent has been applied to the calculated dipole moments to account for field inhomogeneities and the fact that the average of the displacements caused by the top and bottom of the square wave does not yield the displacement corresponding to the applied dc voltage.

Shulman and Townes[1] have recently reported a value of 0.7085 ±0.004 Debye units for the dipole moment of OCS. Our measurements agree with this figure within experimental error. Carbonyl sulfide should prove to be a convenient compound for calibrating a microwave spectroscope in which the systematic errors have not been accurately determined by direct measurement.

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Microwave Spectrum of Methyl Mercaptan

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(Received February 9, 1951)

THE study of the K-Band microwave spectrum of CH_3SH is currently in progress. In the spectroscope, a 48-foot absorption cell is used with a double modulation method which employs both wide range saw-tooth 60 cycle/sec modulation and narrow range sinusoidal 87 kc/sec modulation. This technique in