25,530 cm.$^{-1}$ and an overlapping one of high intensity with the first strong band at 27,910 cm.$^{-1}$. Analogous separations of about 800, 1200 and 1600 cm.$^{-1}$ are evident in the members of each of the two groups. Farther in the ultraviolet is a very intense band with maximum at 40,250 cm.$^{-1}$.

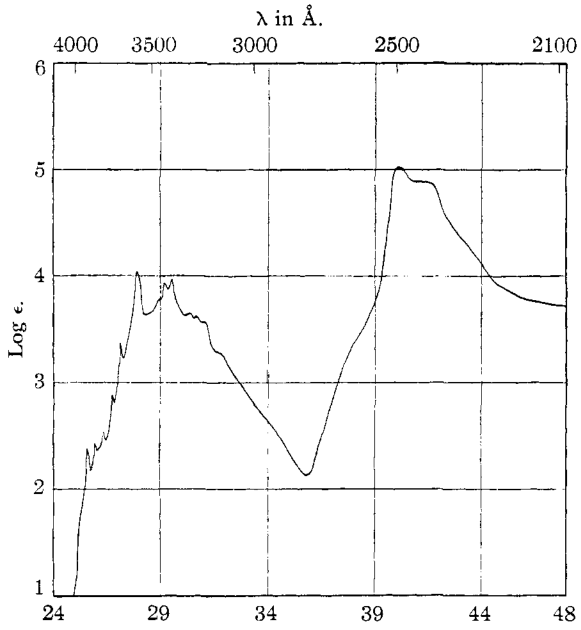

Fig. 1.

The spectrum has certain similarities to those of condensed ring compounds such as naphthalene and fluorene and this relationship would give further evidence in support of the structure of the compound as given by Lothrop.

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RECEIVED AUGUST 8, 1941

Purification of Anthracene

BY O. C. DERMER AND JACK KING

The observations of Clar[1] and Bachmann and Kloetzel[2] on the ease of formation and dissociation of maleic anhydride adducts of anthracenes led us to investigate the purification of anthracene itself by way of the Diels–Alder reaction. This has been discussed recently by Polyakova,[3] but his procedure is complicated by his desire to recover maleic anhydride.

Thirty-five grams of technical anthracene (purity about 80%) and 62 g. of maleic anhydride (200% excess) were added to 700 ml. of benzene and the solution refluxed for ninety minutes. The solid anthracene-9,10-*endo*-α,β-succinic anhydride that separated from the cooled mixture was recrystallized twice from aqueous acetone; yield, 29 g. (67%).

Pyrolysis of this compound by itself proved unsatisfactory, but when it was ground with 40 g. of soda lime and heated strongly in a porcelain dish covered with an inverted funnel and a receiver, anthracene having a slight yellow tinge sublimed out. This was collected and recrystallized twice from toluene. Fifteen grams (80% for this step only) of colorless, highly fluorescent anthracene, m. p. 217° (cor.), was obtained.

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RECEIVED JULY 25, 1941

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[1] Clar, *Ber.*, **64**, 2194 (1931).

[2] Bachmann and Kloetzel, THIS JOURNAL, **60**, 481 (1938).

[3] Polyakova, *Org. Chem. Ind.* (U. S. S. R.), **7**, 305 (1940); *Chemical Abstracts*, **35**, 4008 (1941).

The Dissociation of Tetraphenylhydrazine and its Derivatives

BY GILBERT N. LEWIS AND DAVID LIPKIN

In a recent study by Cain and Wiselogle[1] of the rate of reaction between tetraphenylhydrazine and nitric oxide, it was shown that the rate-determining step is the dissociation of the hydrazine into two diphenylnitrogen radicals. For this process they obtain 30 kcal. as the heat of activation.

In contrast with this high energy of activation for the dissociation process, they point out that, by the ordinary method of calculating bond energies from thermochemical data, the heat of dissociation of hydrazine itself is only 20 kcal.[2] They agree with Wieland[3] that the substitution of phenyl groups would greatly reduce this figure. A large heat of activation for the dissociation and a small heat of dissociation would imply a high activation energy also for the reverse process: the formation of tetraphenylhydrazine from two molecules of diphenylnitrogen.[4] In the analogous reaction by which a molecule of hexaphenylethane is formed from two molecules of triphenylmethyl, activation is required amounting to 6–8 kcal.[5] The existence of such a heat of activation for the recombination of nitrogen free radicals would be of much interest in connection with the theories recently set forth by Lewis and Seaborg.[6]

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[1] Cain and Wiselogle, THIS JOURNAL, **62**, 1163 (1940).

[2] Pauling, "The Nature of the Chemical Bond," Cornell University Press, Ithaca, N. Y., 2nd ed., 1940.

[3] Wieland, "Die Hydrazine," Ferdinand Enke, Stuttgart, 1913.

[4] See also a discussion of this question, *Chem. Soc. London Ann. Repts.*, **37**, 268 (1940).

[5] Ziegler, Orth and Weber, *Ann.*, **504**, 131 (1933).

[6] Lewis and Seaborg, THIS JOURNAL, **61**, 1886 (1939).