

(3 μ C.) was calculated from data on pair production and γ -ray absorption in lead.

The second standard was a source of sodium-22 in a plastic mounting which had been calibrated against a cobalt-60 standard as follows. The sodium-22 and cobalt-60 sources were placed successively in front of a counter screened by 3 cm. of lead. The ratio of counting-rates remained constant to within a few per cent as the thickness of lead was increased from 3 cm. to 5 cm., justifying the assumption that all annihilation radiation is thus filtered off. Since the γ -energy of sodium-22 (1.28 MeV.) is almost the same as the mean γ -energy of the cobalt-60 lines (1.25 MeV.), this comparison affords a convenient method of calibrating sodium-22 (and hence indirectly any positron emitter).

These two standards agreed to within a few per cent.

A final value of $(7.6 \pm 1.9) \times 10^{-4}$ was obtained for the pair conversion coefficient of the 2.78-MeV. line of sodium-24. This agrees well with the theoretical result predicted for an electric quadrupole. (Brady and Deutsch³ have shown that this line is very likely to be a quadrupole transition.) Rae⁴ obtained $(11.6 \pm 1) \times 10^{-4}$ for the pair conversion coefficient of the same line by a different method, the primary object of which was to determine the spectrum of the positron.

We are indebted to Prof. R. E. Peierls and Dr. G. K. Horton for interesting discussions, and to Lord Cherwell for facilities in this Laboratory.

Note added in proof. In more recent measurements the positrons were stopped in beryllium instead of plastic. A pair conversion coefficient of $(3.25 \pm 1.05) \times 10^{-4}$ was obtained.

Clarendon Laboratory,
Oxford. Aug. 1.

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¹ Rose, M. E., *Phys. Rev.*, **76**, 678 (1949).

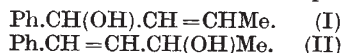
² Bradt, E., Halter, J., Heine, H. G., and Scherrer, P., *Helv. Phys. Acta*, **19**, 445 (1946).

³ Brady, E. L., and Deutsch, M., *Phys. Rev.*, **78**, 558 (1950).

⁴ Rae, E. R., *Phil. Mag.*, **40**, 1155 (1949).

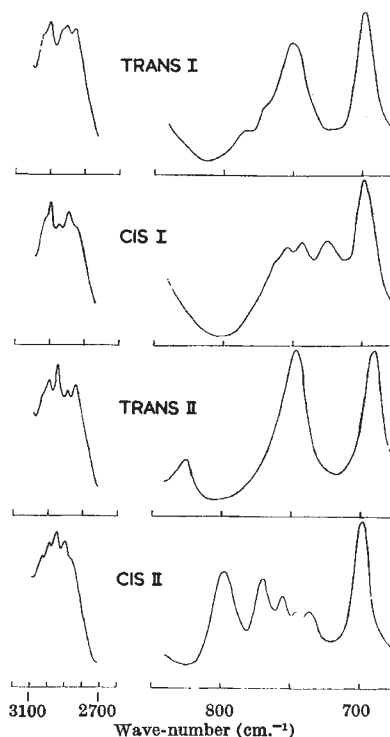
Infra-Red Spectra of Unsaturated Aromatic Carbinols

THE infra-red absorption spectra of both the *cis*- and *trans*-isomers of phenyl propenyl carbinol (I) and styryl methyl carbinol (II) have been recorded in these laboratories. Highly purified samples of these compounds were given to us by Dr. E. A. Braude and Mr. J. A. Coles. The *trans*-isomers have been described previously¹; the *cis*-isomers are new and their preparation will be described separately².



In view of the current interest in the C—H deformation frequencies of *cis*- and *trans*-olefines³⁻⁵ and unsaturated alcohols^{6,7}, parts of the spectra are reproduced here. The *trans*-isomers were expected to absorb at 965 cm^{-1} and the *cis*-isomers in the 650–750 cm^{-1} region.

The 965 cm^{-1} region is unfortunately complicated by absorption due to the COH-group. At lower frequencies the *trans*-isomers gave the normal spectra of mono-substituted aromatics, namely, two strong bands at about 690 cm^{-1} and 760 cm^{-1} . These two bands (presumably due to aromatic C—H deformation⁸) occur in the spectra of mono-alkyl benzenes, styrene and substituted styrenes, and benzyl and α -substituted alcohols.



Spectra of unsaturated aromatic carbinols. Spectra recorded on Perkin-Elmer 12B spectrometer. 2,600–3,200 cm^{-1} , no dilution, cell 0.025 mm.; 650–850 cm^{-1} , approximately 10 per cent solution in cyclohexane, cell 0.1 mm. Absorption plotted upwards

The *cis*-isomers gave only 690 cm^{-1} absorption, the other one being replaced by a series of weaker bands. We have, then, the expected absorption due to the *cis*-unsaturation but also a reduction in intensity of the aromatic band. This occurs not only in the spectrum of (II), where conjugation might cause a change in frequencies associated with the phenyl group, but also in that of (I), where the unsaturation is separated from the ring.

In view of this effect on the aromatic C—H deformation frequencies, the C—H stretching absorptions near 3,000 cm^{-1} were examined. With the limited resolving power afforded by a rock-salt prism, it was found that both *trans*-isomers give a maximum at 2,850 cm^{-1} where the *cis*-isomers have only a shoulder. This frequency seems too low for an aromatic C—H absorption.

These differences in spectra afford an empirical method of identifying the *cis*- and *trans*-isomers. No attempt has been made to interpret them in terms of molecular structure, although the information may be of use in assigning the absorption frequencies of similar molecules.

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¹ Braude, Jones and Stern, *J. Chem. Soc.*, 396 (1946).

² Braude and Coles (forthcoming publication).

³ Anderson and Seyfried, *Anal. Chem.*, **20**, 998 (1948).

⁴ Sheppard and Sutherland, *Proc. Roy. Soc., A*, **196**, 195 (1949).

⁵ Catalogue of Infra-Red Spectrograms (Amer. Petrol. Inst., Nat. Bur. Stand., Washington, 1948).

⁶ Crombie and Harner, *J. Chem. Soc.*, 873 (1950).

⁷ Sondheimer, *J. Chem. Soc.*, 877 (1950).

⁸ Whiffen and Thompson, *J. Chem. Soc.*, 268 (1945).