

bromide, iodide, allyl ether and allyl sulphide; vinyl acetate, chloride and cyanide; methyl acrylate, methacrylate, maleate, fumarate, citraconate and mesaconate; maleic and citraconic anhydrides; styrene,  $\alpha$ -bromo-styrene, stilbene, benzylidene-acetone, indene, bicyclopentadiene. The yields are generally good. Allyl ether and allyl sulphide react with two molecules of benzonitrile oxide. With methyl maleate and fumarate, methyl citraconate and mesaconate, two different phenylisoxazoline-dicarboxylic acid dimethyl esters have been obtained, probably the *cis* and *trans* isomers which are theoretically possible for isoxazoline derivatives of type (II).

Since an ethereal solution of benzonitrile oxide is readily prepared from benzhydroximic chloride,  $C_6H_5C(:NOH)Cl$  (in ether), and aqueous sodium hydroxide, and as the isoxazoline derivatives obtained are solids easily crystallizable and with definite melting points, the reaction can be of value for the identification of unsaturated liquid substances, and gives a new way for studying the reactivity of different types of double bonds.

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<sup>1</sup> Quilico, A., and Speroni, G., *Gazz. Chim. It.*, **76**, 148 (1946); Stagno d'Alcontres, A. Q., and Stagno d'Alcontres, G., *ibid.*, **80**, 140 (1950).

### Structure of cyclo-Octatetraene

A COMMUNICATION<sup>1</sup> on the above topic has just come to our attention, in which the authors have reasoned from some frequency calculations to the conclusion that *cyclo*-octatetraene probably has the  $D_{4d}$  structure, with the  $D_4$  structure a less likely possibility. It is the purpose of the present note to point out that the vibrational spectra<sup>2</sup> of the deuterium derivative of *cyclo*-octatetraene, published some time ago, enable the method of reasoning as well as the  $D_{4d}$  conclusion to be refuted.

The frequency calculations<sup>1</sup> are based on the  $D_{4d}$  model, which has high symmetry and thus lightens the numerical burden. On the basis of an assumed set of force constants, the twenty-six distinct frequencies were calculated and compared with the observed spectra. The agreement between calculated and observed values was then taken to indicate that the assumed structure was correct. Among others, there are the following difficulties with this argument. The calculation places a total of seven C—H bending frequencies in the region 1,550–1,750  $cm^{-1}$ , of which all but one are identified with observed frequencies in the range 1,442–1,734  $cm^{-1}$ . If this identification is correct, the frequencies would be calculated to shift in the deuterium analogue by about a factor 0.7–0.8. In practice, the shifts are very much smaller than this for *all* the principal observed frequencies in the range 1,442–1,734, the largest being about 10 per cent, and most changing by only 2–5 per cent. Thus the agreement between calculation and experiment would be badly spoiled in the deuterium compound, which presumably has the same structure and force constants.

The authors also state that 'the very strong infra-red frequency at 675 has to be explained as a

combination'. This band is indeed very strong, being the most intense in the rock-salt region. It is therefore doubtful whether it should be assigned to a combination-tone. The difficulty is the more acute because at 629 there is a second, even stronger band, of which Saksena and Narain<sup>1</sup> were apparently unaware. Actually, we believe this pair of bands is a resonance doublet arising from interaction between an extremely intense fundamental and a combination tone. The analogous band in the deuterium compound is single<sup>2</sup>.

The most serious objection to the  $D_{4d}$  structure is not mentioned by Saksena and Narain, although it has been pointed out several times<sup>3,4</sup>. The selection rules for this structure forbid the appearance of a given vibration in both infra-red and Raman spectra. There are observed about a dozen coincidences, all told, between the principal infra-red and Raman frequencies in *cyclo*-octatetraene, and one or two less in the deuterium analogue. These might, of course, be called 'accidental' or the result of violation of selection rules. It seems more straightforward to assume that the  $D_{4d}$  structure is not correct and to consider instead structures that require a limited number of coincidences, such as  $D_4$  (10 coincidences) or  $D_{2d}$  (15). We believe the  $D_4$  structure to be the actual one.

We have recently issued two reports<sup>5,6</sup> of our work on the structure of *cyclo*-octatetraene under the auspices of the U.S. Navy's Office of Naval Research. The subject-matter of these reports will be submitted in the immediate future for publication in the *Journal of the American Chemical Society*.

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<sup>1</sup> Saksena and Narain, *Nature*, **165**, 723 (1950).

<sup>2</sup> Lippincott, Lord and McDonald, *J. Chem. Phys.*, **16**, 548 (1948).

<sup>3</sup> Flett, Cave, Vago and Thompson, *Nature*, **159**, 739 (1947).

<sup>4</sup> Lord, *J. Chim. Phys.*, **45**, 47 (1948).

<sup>5</sup> Lippincott, Lord and McDonald, "Vibrational Spectra and Structure of Cyclooctatetraene", Tech. Rep. No. 1, Spectroscopy Laboratory, Massachusetts Institute of Technology.

<sup>6</sup> Lippincott and Lord, "The Thermodynamic Functions of Cyclooctatetraene", Tech. Rep. No. 2, Spectroscopy Laboratory, Massachusetts Institute of Technology.

### 'Heterochromatin'

THE purpose of this letter is to suggest that the use of the word 'heterochromatin' in cytological and genetical literature is undesirable. The word was introduced by Heitz<sup>1,2</sup> to indicate those *Chromosomenstücke* and whole chromosomes that do not undergo telophase transformation and therefore remain condensed throughout interphase and prophase. The later work on this subject, particularly that showing the differential reaction of the heterochromatic parts of chromosomes to culture at low temperature<sup>3-8</sup>, has been of great interest and importance, and we want to criticize the name only and not the associated subject-matter.

The ending in '-in' suggests strongly that the name applies to a single chemical substance or to a group