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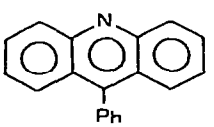
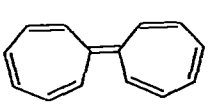
Book review

Electron Spin Resonance, Volume 2 (a specialist periodical report), R.O.C. Norman, senior reporter, The Chemical Society, London, 1974, x + 349 pages, £ 9.50.

This review of electron spin resonance is said to cover the literature published between June 1972 and November 1973. In general the treatment is good. It will probably prove to be a useful reference for most practitioners of ESR. For others the following is a review of the review (of reviews in part).

Chapter 1 on theoretical aspects of hyperfine splittings and *g*-factors by C. Thomson unfortunately will be most useful only to those familiar with the following acronyms: SCF, SO-SCF, MC-SCF, SCF-CI, LCAO-SCF-MO-CI, CNDO/2 and CNDO/SP, INDO and INDO-G, NSO and N-NSO, STO-3G, GTO and 3GTO/1STO, FO, UHF, RHF, SPHF, MCHF, MBPT, LG, LW, DZ, MZS and DZS, NDDO, MZDO and ZDO, IEPA-PNO and DEPAC. N.M. Atherton in Chapter 2 "sees no breathtakingly dramatic developments but a considerable number of interesting items" in the literature on ENDOR and ELDOR. About a dozen review articles on double resonance techniques and/or theory are cited. Little ENDOR work with inorganic or organometallic radicals has apparently been reported. Only CO_2^- in sodium hydrogen oxalate monohydrate and AsO_4^{4-} in KH_2AsO_4 are mentioned. Solution studies include metal ENDOR of lithium, sodium and rubidium in complexes with di-*o*-mesitoylbenzene radical anions and both ENDOR and ELDOR studies of trapped electrons are reviewed. Chapter 3 on relaxation processes and linewidths by P.W. Atkins is mainly concerned with: (1) Experimental and theoretical aspects of relaxation in chemically polarized electron spin states. (2) Molecular motion in liquids, in solids and under intermediate conditions of slow motion. Here one can find the state-of-the-art in spin-labelling of large molecules by nitroxides. (3) Line width effects on (a) dimeric species; for example tetrakis (*N*,*N*-diethyldithiocarbamato)dicopper(II) or the zinc(II) complex, the copper tartrate dimer, $Cu_2(dmg)_4$ and bis(*N*-salicylidenemethylamino)copper(II), (b) manganese compounds; $Mn(CH_3CO_2)_2 \cdot 4H_2O$, $Mn(CHO_2)_2 \cdot 2H_2O$, $Mn(C_4H_4O_6)$, $Mn(PO_3)_2$, $MnSO_4 \cdot 2H_2O$, and $MnBr_2$, (c) vanadyl(IV) α-hydroxycarboxylate complexes; e.g. benzilic, mandelic, α-hydroxyisobutyric, lactic and glycolic. Chapter 4 on triplets and biradicals by A. Hudson reviews studies on the usual relatively stable organic biradicals and ground state triplets. The triplet ground states of $\dot{N}N\dot{C}$ and $\dot{N}C\dot{N}$ are mentioned. The use of ESR and optically detected magnetic resonance to study optically produced short-lived triplets is also included. Chapter 5 by R.F. Adams and W.E.J. Foster on radical ions, ion pairs and dynamic processess contains a couple of errors in structural pictures and sometimes overlaps material in other chapters. Phenylacridine and heptafulvalene are respectively:





Chapter 6 on transition-metal ions seems to be a thorough review of the area. Subtitles include: theory and techniques; Jahn-Teller effects; complexes in framework minerals; free-radical complexes; dipole—dipole and exchange interactions. Then examples where $S = ½$: S^1 configuration (rhodium atoms, univalent cadmium, and bivalent scandium; d^1 (bivalent scandium and yttrium, tervalent titanium, quadrivalent vanadium and niobium, quinquevalent chromium, molybdenum and tungsten, and sexivalent manganese; d^3 (tervalent molybdenum); d^5 (tervalent iron and ruthenium); d^7 univalent iron and ruthenium, bivalent cobalt and iridium, and tervalent nickel, d^9 (bivalent copper in ionic lattices, bivalent copper with a d_{z^2} ground state, bivalent copper complexes as crystals, univalent nickel and palladium, and bivalent silver. Next examples where $S = 1$: d^2 configuration (bivalent titanium, tervalent vanadium, and quadrivalent chromium; d^8 (bivalent nickel). Next where $S = 3/2$: d^3 (bivalent vanadium, tervalent chromium and molybdenum, quadrivalent manganese; d^7 (bivalent cobalt). Next where $S = 3/2$, namely $S = 2$ (bivalent iron and chromium, tervalent cobalt; $S = 5/2$ (bivalent manganese, tervalent iron). A section on lathanides and actinides is included. In Chapter 7 on inorganic radicals by T.A. Claxton and B.W. Fullam "those small radicals which are directly pertinent to the understanding of structure and reactivity in inorganic chemistry" are discussed. The reader is brought up-to-date on recent ESR studie s of small molecule radicals in Groups II through VII. References to paramagnetic centers in irradiated diamonds, glasses and semiconductors are included as well as to studies of the radiation chemistry of some aqueous salt solutions. Some material in this chapter overlaps with the previous chapter on transition metal ions. Chapter 8 by B.C. Gilbert and R.C. Sealy on organic radicals is a very extensive review of the area and should be of interest to all organic free radical chemists. Chapter 9 by A. Hudson on organometallic radicals is perhaps of most interest to organometallic chemists. More examples of radicals detected by ESR containing Groups IV and V elements are reviewed. A few radicals containing magnesuim or boron are also included. Perhaps more novel are the ESR studies of transition metal organometallic radicals containing vanadium, niobium, chromium, iron and manganese. Chapter 10 by A.J. Dobbs is on g-factors of free radicals in fluid solutions. Quite an extensive coverage of this rarely reviewed topic is given. It promises to be quite useful for future reference. Chapter 11 by T. Lund and J.B. Raynor on biological systems is said to review all biological related papers where ESR results are mentioned, regardless of the quality of the material. This makes for a lengthy chapter. The following subtitles are given: lipids, membranes, protein conformation, radiation damage in proteins, photosynthesis, haem, cobalt-substituted haem, nitrosyl haem, cytochromes, copper proteins, flavoproteins, iron—sulphur proteins, corrins, proteolytic enzymes, other enzymes, carbohydrates, drugs, tissue, miscellaneous systems. An author index is provided.

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