Syntheses of Optically Active Multi-layered [2,2]Paracyclophanes with Known Absolute Configurations

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Summary The syntheses of optically active forms of triple- and quadruple-layered [2,2]paracyclophanes are reported.

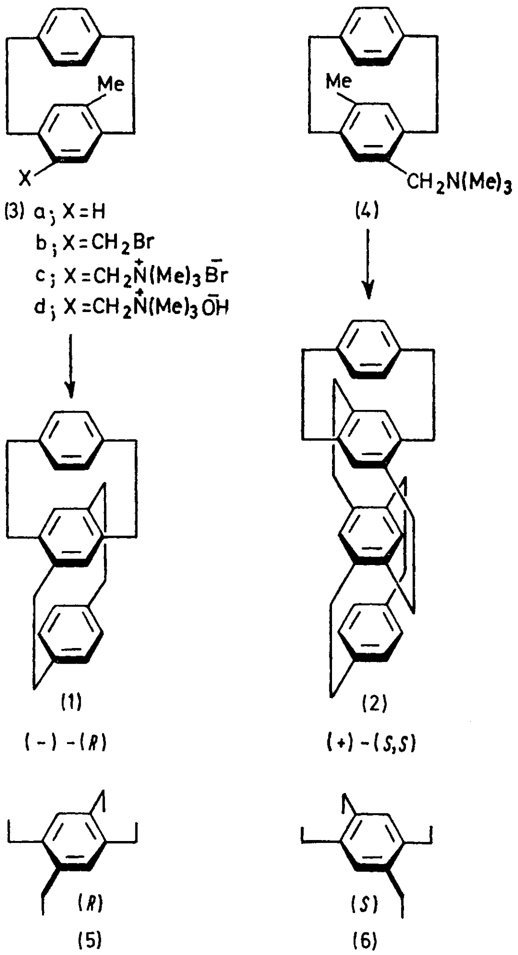
We have previously reported[1] the preparations of doubly bridged [8][8]paracyclophane and [8][10]paracyclophane, which have D_2 and C_2 symmetry respectively, and both are chiral. The synthesis of optically active [8][10]paracyclophane is reported in the following communication.[2] The triple- and quadruple-layered [2,2]paracyclophanes (**1**) and (**2**) have D_2 symmetry, equivalent to that of [8][8]paracyclophane.

Bromomethylation of (−)-(*R*)-4-methyl[2,2]paracyclophane (**3a**)[3] with formaldehyde, HBr, and phosphoric acid afforded the bromomethyl derivative (**3b**) which was converted (Me_3N) into the quaternary ammonium bromide (**3c**), m.p. 244—246°, $[\alpha]_D^{27}$ − 32° ($CHCl_3$). A mixture of (**3c**) and *p*-xylyltrimethylammonium bromide (1:1·5) was treated with silver hydroxide, giving a mixture of Hofmann bases which was pyrolysed in boiling toluene. Trimethylamine was evolved smoothly, and the resulting mixture was chromatographed on neutral alumina to give [2,2]paracyclophane (7%) and the optically active triple-layered [2,2]-paracyclophane (**1**) (5%), m.p. 169—170°, $[\alpha]_D^{28}$ − 256° ($CHCl_3$).

The optically active quadruple-layered [2,2]paracyclophane (**2**), m.p. 229—230°, $[\alpha]_D^{28}$ + 250° ($CHCl_3$), was obtained by the pyrolysis, in boiling toluene, of the (*S*)-quaternary ammonium hydroxide (**4**) [the enantiomer of (*R*)-(**3d**)].

The u.v. and n.m.r. spectra of (**1**) and (**2**) are similar to those of the methyl substituted racemic analogues reported previously.[4,5]

The chirality of multi-layered [2,2]paracyclophanes may be expressed by specifying the planar chirality,[6] (**5**) or (**6**), of each of the inner benzene rings; *e.g.* (**1**) and (**2**) may be described, respectively, as (−)-(*R*)-(**1**) and (+)-(*S*,*S*)-(**2**).



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