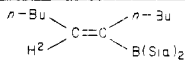
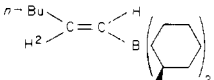
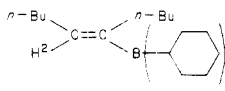
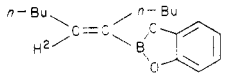
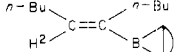
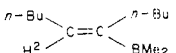
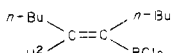
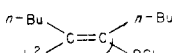
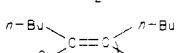
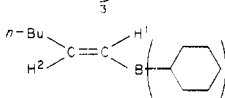
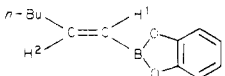
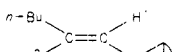
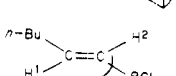


Table I. Alkenylboranes Which Exhibit Two Kinds of Olefinic Signals^a

borane	chemical shift (δ in CCl_4)				
	H ¹	H ²	Δ H ¹	Δ H ²	other
 2		6.02 5.92		0.1	2.40-2.04 (4 H, m), 2.00-1.60 (4 H, m), 1.60-1.15 (8 H, m), 1.08-0.72 (24 H, m)
1	6.30 6.25	6.81 6.76	0.05	0.05	2.35-2.10 (2 H, m), 1.85-1.50 (4 H, m), 1.50-1.15 (4 H, m), 1.05-0.70 (21 H, m)
	6.22 6.16	6.74 6.68	0.06	0.06	2.40-2.12 (2 H, m), 1.80-1.04 (24 H, m), 0.94 (3 H, t, $J = 6$ Hz), 0.76-0.60 (6 H, m)

^a The methylene protons adjacent to the double bond were irradiated. The decoupled spectrum of **2** showed two kinds of singlet in the H² region, and the spectra of the (1-hexenyl)boranes showed two kinds of doublet in both H¹ and H² regions. Δ Hⁿ indicates the difference between two chemical shifts in the Hⁿ region.

Table II. Alkenylboranes Which Exhibit One Olefinic Signal^a

borane	chemical shift (δ in CCl_4)		
	H ¹	H ²	other
 3		5.60 ^b	c
		6.72	7.25-6.85 (4 H, m), 2.42-2.00 (4 H, m), 1.60-1.12 (8 H, m), 1.04-0.90 (6 H, m)
		6.54	2.40-2.14 (4 H, m), 2.08-1.72 (12 H, m), 1.60-1.16 (10 H, m), 0.94 (6 H, t, $J = 6$ Hz)
		6.42	2.50-1.88 (4 H, m), 1.63-1.13 (8 H, m), 0.98 (6 H, t, $J = 7$ Hz), 0.79 (6 H, s)
		7.06	2.50-2.10 (4 H, m), 1.66-1.13 (8 H, m), 0.93 (6 H, t, $J = 6$ Hz)
		6.17	2.25-1.83 (8 H, m), 1.83-1.08 (16 H, m), 1.08-0.68 (12 H, bs)
		5.80 ^b	c
	6.19 ^b	6.78 ^b	c
	5.60	d	7.15-6.80 (5 H, m), 2.40-2.10 (2 H, m), 1.70-1.30 (4 H, m), 0.94 (3 H, t, $J = 6$ Hz)
	6.10	6.72	2.28-2.08 (2 H, m), 2.00-1.60 (12 H, m), 1.44-1.08 (6 H, m), 0.90 (3 H, t, $J = 6$ Hz)
	6.08	6.98	2.48-1.85 (4 H, m), 1.68-1.08 (8 H, m), 0.91 (6 H, t, $J = 6.8$ Hz)

^a Irradiation was performed as in Table I. The decoupled spectra of the (5-decenyl)boranes showed a singlet in the H² region and those of the (1-hexenyl)boranes showed a doublet in both the H¹ and H² regions. ^b THF solution. ^c The solvent (THF) signals masked the methyl and methylene protons. ^d Phenyl proton signals masked the H¹ signal.

and meso compounds) since the alkenylboranes in Table I possess two asymmetric carbons (Scheme I). Indeed, the boranes in Table II do not possess any asymmetric centers.

Accordingly, we prepared (1-hexenyl)diisopinocampheylboranes (**6a,b**) from optically pure (+)- α -pinene and from racemic (\pm)- α -pinene and examined their ¹H NMR spectra. The data are listed in Table III. As would be expected, two kinds of olefinic signals appeared in **6b**.

One type of signal (δ 6.60 and 6.24) must be ascribed to the meso isomer (such as **5**) and the other (δ 6.24 and 6.28) to the enantiomers (such as **4a** and **4b**).

In conclusion, it is now clear that diastereomeric alkenylboranes can be distinguished by the two kinds of chemical shifts of the alkenyl protons. Although the other protons of such isomers should also appear in different regions, complex overlapping of methyl or methylene protons prevents clear analysis.

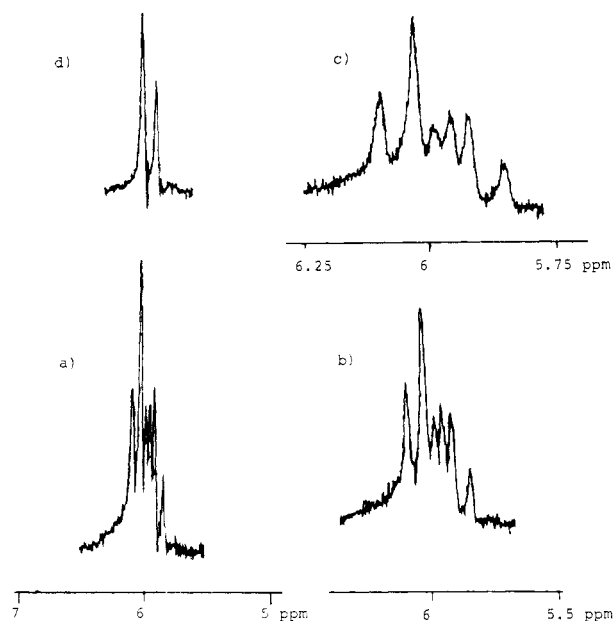


Figure 1. ^1H NMR spectra of the olefinic region of **2**: (a) width $\times 1$; (b) width $\times 2$; (c) width $\times 4$. (d) The decoupled spectrum of **2**.

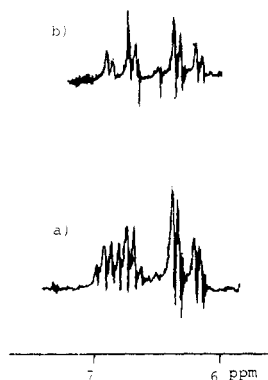


Figure 2. (a) ^1H NMR spectrum of the olefinic region of **1**. (b) The decoupled spectrum of **1**.

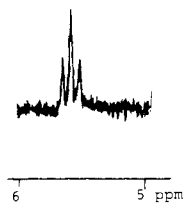


Figure 3. ^1H NMR spectrum of the olefinic region of **3**.

Experimental Section

Most of the boranes were prepared according to the standard procedure.³ (5-Decenyl)dimethylborane,⁴ (5-decenyl)dichloroborane,⁵ bis(5-decenyl)chloroborane,⁶ and bis(1-hexenyl)chloroborane⁶ were prepared as previously described. Some of the boranes were distilled under reduced pressure, and others were used after evaporation of the solvent. Boiling ranges at reduced pressures are as follows: 5-decenyl-9-BBN, 152–154 °C (0.02 mmHg); bis(5-decenyl)chloroborane, 110–115 °C (0.005 mmHg); (5-decenyl)dimethylborane, 43–45 °C (1 mmHg); (5-decenyl)dichloroborane, 64–70 °C (2 mmHg); bis(1-hexenyl)chloroborane, 70–72 °C (0.05 mmHg); (1-hexenyl)(1,2-phenylenedioxy)borane,

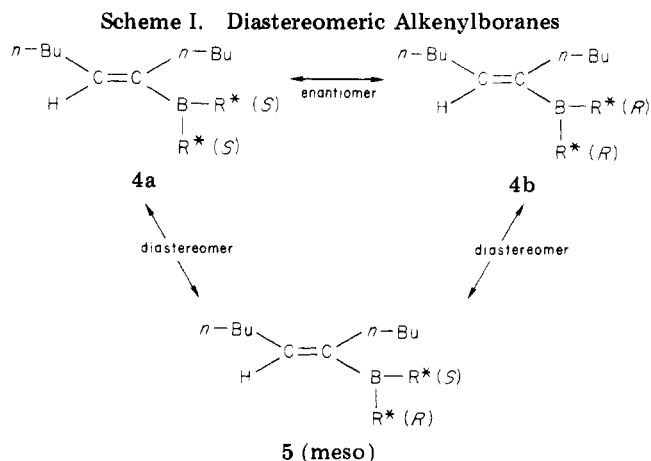
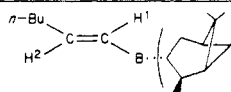


Table III. ^1H NMR Spectra of (1-Hexenyl)diisopinocampheylboranes^a

borane	chemical shift (δ in THF)			
	H ¹	H ²	ΔH^1	ΔH^2
	6.64	6.28		
from (+)- α -pinene				
6b	6.64	6.28	0.04	0.04
from (\pm)- α -pinene	6.60	6.24		

^a See footnote *a* to Table I. The NMR spectra were recorded in THF.

60–70 °C (0.01 mmHg); 1-hexenyl-9-BBN, 52–55 °C (0.01 mmHg). ^1H NMR spectra were measured on a JEOL PS-100 spectrometer. Chemical shifts are in parts per million, referenced to Me_4Si .

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Registry No. **1**, 55168-92-8; **2**, 69082-89-9; **3**, 69082-90-2; **6a**, 70179-28-1; (\pm)-**6b**, 70223-51-7; *meso*-**6**, 70223-52-8; (*E*)-(1-hexenyl)bis(*trans*-2-methylcyclohexyl)borane, 70223-53-9; (*Z*)-(5-decenyl)(1,2-phenylenedioxy)borane, 70179-29-2; (*Z*)-(5-decenyl)-9-borabicyclo[3.3.1]nonane, 69322-52-7; (*Z*)-(5-decenyl)dimethylborane, 64285-24-1; (*Z*)-(5-decenyl)dichloroborane, 64285-25-2; bis[(*Z*)-(5-decenyl)]chloroborane, 64323-54-2; tris[(*Z*)-(5-decenyl)]borane, 70179-30-5; (*E*)-(1-hexenyl)dicyclohexylborane, 37609-12-4; (*E*)-(2-hexenyl)(1,2-phenylenedioxy)borane, 37490-22-5; (*E*)-(1-hexenyl)-9-borabicyclo[3.3.1]nonane, 69322-45-8; bis[(*E*)-(1-hexenyl)]chloroborane, 41929-38-8.

Simple and Mild Dehalogenation Reactions Effected by Molybdenum Hexacarbonyl on Alumina

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One of the most active areas of research in organic chemistry involves the use of reagents supported on porous solids to effect various synthetic transformations. Such reactions often occur under gentle conditions, are simple to work up, and can be selective as well. Recent studies,

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