JOC*Note*

Highly Stereoselective *C*-Allylation of an Enantiopure α-Sulfinyl Thioacetamide

Stéphanie Nowaczyk,† Carole Alayrac,*,† Patrick Metzner,*,† and Marie-Thérèse Averbuch-Pouchot‡

Laboratoire de Chimie Moléculaire et Thio-organique (UMR CNRS 6507), ISMRA-Université de Caen, 6 Boulevard du Maréchal Juin, F-14050 Caen, France, and LEDSS (UMR CNRS 5616), Université Joseph Fourier, BP 53, F-38041 Grenoble, France

patrick.metzner@ismra.fr

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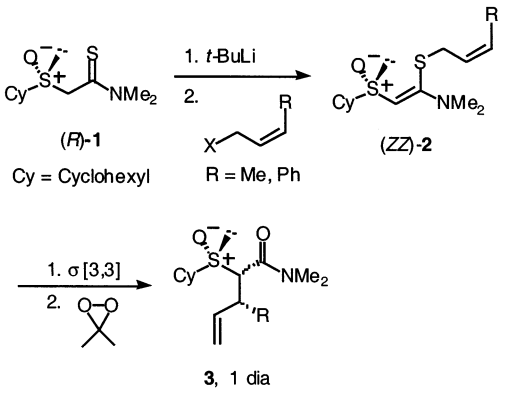
Abstract: The alkylation of the lithium enolate of enantiopure α-cyclohexylsulfinyl thioacetamide **1** with allyl bromides **5** possessing an electron-withdrawing group at the vinylic position does not occur at the sulfur center − as expected in the sulfur series − but at the carbon center through conjugate addition followed by bromide elimination. The modest to excellent 1,2-asymmetric induction achieved by the alkylsulfinyl group (dr up to 100:0) is explained by an electronic model.

The direct allylation of α-sulfinyl carbonyl compounds is usually poorly stereoselective as exemplified by the reaction of anions of α-sulfinyl esters or ketones with allyl halides.[1] The only case leading to good diastereoisomeric excess was described by Fujita and involved the alkylation of α-sulfinyl α-alkylated ketones.[2] Two other particular examples can be noted: the allylation of α-sulfinyl α-alkylated radicals[3] and the allylation of a cyclic α-sulfinyl ketone under *phase-transfer catalysis*.[4]

Recently we described[5] an original access to optically pure α-allyl α-sulfinyl acetamides **3** (Scheme 1) via chemoselective oxidation of the analogous thioacetamides resulting from the asymmetric thio-Claisen rearrangement of (*ZZ*)-ketene aminothioacetals **2**, prepared by *S*-allylation of the enolate of thioacetamide[6] **1** with allyl bromides. In this Note, we report that with allyl reagents possessing electron-withdrawing substituents, the enethiolate of **1** does not undergo the generally observed *S*-allylation but an unexpected direct *C*-allylation with a modest to excellent 1,2-asymmetric induction of the sulfinyl group.

SCHEME 1



The Claisen rearrangement is an invaluable method for the stereoselective formation of the C−C bond, especially in acyclic series.[7] We have recently reported the first examples of asymmetric [3.3] sigmatropic rearrangements mediated by racemic alkylsulfinyl groups.[8] The methodology was then successfully extended to the enantiopure series.[5] Indeed, ketene aminothioacetals **2** bearing an enantiopure vinylic alkylsulfinyl substituent were readily prepared from (*R*)-2-cyclohexylsulfinyl-*N*,*N*-dimethylethanethioamide (**1**) with full control of the geometry of their double bonds. Compounds **2** underwent a diastereoselective Claisen rearrangement (100% de) upon heating at THF reflux and the resulting α-sulfinyl γ-unsaturated thioamides were readily converted into the parent amides **3** by oxidation with dimethyldioxirane.

As the introduction of electron-withdrawing substituents on the allylic moiety of ketene acetals is known to accelerate their sigmatropic transposition,[9] we wished to examine the Claisen rearrangement of substrates **4a**−**d** (Scheme 2). According to our previous studies,[5] substrates **4a**−**d** should be readily accessible from the reaction of the lithium enolate of thioamide **1** at −40 °C respectively with 2-(bromomethyl)acrylic acid **5a** (R = CO_2H) and allyl halides **5b**−**d** (R = CO_2Me, CN, SO_2t-Bu), which preparation is described in the literature.[10] However, to our surprise, the *S*-allylation products **4a**−**d** could not be detected by either TLC or ^1H NMR and the only isolated products were thioamides **6a**−**d**—the expected Claisen rearrangement products of **4a**−**d** (Scheme 2). Moreover,

* Author to whom correspondence should be addressed. Fax: +33 231 452 877.
† ISMRA-Université de Caen.
‡ Université Joseph Fourier, Grenoble.

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SCHEME 2

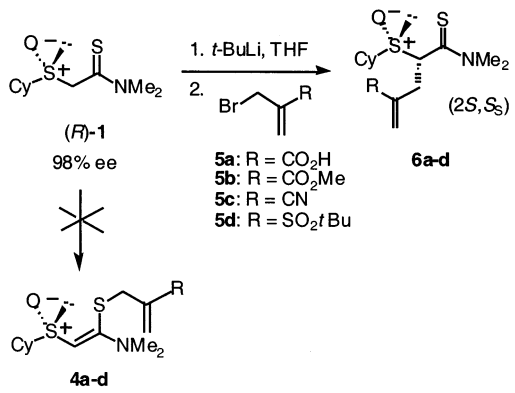

TABLE 1. *C*-Allylation of Sulfinyl Thioamide 1

entry	R	temp (°C)	time (min)	product	dr	yield (%)
1	CO_2H	−40 to rt	90	**6a**	100:0	42
2	CO_2Me	−90	10	**6b**	78:22	100[a]
3	CO_2Me	−70	5	**6b**	78:22	90[a]
4	CO_2Me	−40	5	**6b**	85:15	82
5	CO_2Me	0	10	**6b**	92:8	55
6	CO_2Me	20	10	**6b**	97:3	57
7	CO_2Me	45	10	**6b**	96:4	45
8	CO_2Me	60	5	**6b**	90:10	46
9	CN	−70	10	**6c**	88:12	80
10	CN	−40	10	**6c**	91:9	87
11	CN	0	10	**6c**	95:5	76
12	SO_2t-Bu	−30	10	**6d**	58:42	73
13	SO_2t-Bu	−70	35	**6d**	65:35	70
14	SO_2t-Bu	−90	50	**6d**	66:34	70

[a] Crude yield.

in the case of **6b**,**c**, the reaction was complete after only 5 to 10 min at −40 °C. This result was quite unforeseen in view of the sigmatropic transposition of substrates **2** (Scheme 1), which proceeded in a few hours at THF reflux.[5] **6a** was obtained as a single isomer (100% de). The diastereomeric ratio of **6b**−**d** was measured by integration of the ^{1}H NMR signal of the diastereomeric proton and ranged from 58:42 to 91:9 (Table 1, entries 4, 10, and 12). In all cases, the ^{1}H NMR signals of the proton linked to the stereogenic carbon center of the major isomer were shifted toward lower δ values.

Thorough examination of the influence of the temperature of alkylation on the diastereopurity of **6b** (R = CO_2Me) led to another unanticipated result: the diastereomeric ratio decreased at lower temperature than −40 °C (entries 2−3) but increased at higher temperature to reach a maximum of 97:3 at 20 °C (entry 6). A further increase of the temperature of allylation led to a lower diastereomeric ratio (entry 8). A similar trend was observed in the case of **6c** (entries 9−11) and the best diastereoselectivity (95:5 dr) was obtained at 0 °C (entry 11). By contrast, the diastereomeric ratio of **6d** was improved at lower temperature but still remained modest (66:34 at −90 °C). While the formation of **6b**,**c** was extremely fast, being complete after less than 10 min even at −70 °C, that of **6a**,**d** was slower (entries 1 and 13). Both diastereomers of thioamides **6b**−**d** could be separated either by flash chromatography on silica gel or by crystallization. The enantiomeric excess of the major isomer of **6b**,**c** (respectively 96% and 98%) was determined by HPLC analysis (Daicel AD column) as identical with that of the precursor (*R*)-**1** (98% ee), demonstrating that the stereopurity of the initial sulfoxide was preserved.

The (2*S*,S_S) configuration of the major isomer of **6c** was deduced from the X-ray crystallographic analysis of a single crystal of its minor isomer. The same configuration was assigned to **6a** and to the major isomer of **6b**,**d** according to similar trends observed in the proton NMR spectra.

The (2*S*,S_S) configuration was common to all thio-Claisen rearrangement products obtained from thioamide **1**. However, the fact that the formation of **6b**,**c** was *quasi* instantaneous at very low temperature made us question whether the mechanism was really an *S*-allylation reaction of the enethiolate of **1** and subsequent Claisen rearrangement.

Enethiolates[11,12] are soft, ambident nucleophiles which may react through the carbon atom (with ketones and aldehydes) or through the sulfur atom (with alkyl halides) depending on the electrophile. In particular, with Michael acceptors,[12,13] dithioester enolates undergo *C*-alkylation and the reaction is known to be very fast even at low temperatures. Now, allyl halides **5a**−**d** can be viewed as Michael acceptors. Then the reaction between the lithium enolate of thioamide **1** with **5a**−**d** probably proceeds via a conjugate addition at the carbon center, followed by elimination of the bromide anion. Such a mechanism would explain why the *S*-allylation products **4a**−**d** were not detected. Moreover, the fact that the reaction was slower in the case of **6a** may be related to the less strong electron-withdrawing character of the carboxylate group as compared to that of the ester or cyano functions.

We observed that the selectivity of the formation of the thioamides **6b**,**c** was higher when the temperature of allylation increased (entries 2 to 6 and 9 to 11). We checked that no isomerization was occurring at room temperature or by heating. These results may be explained by the isoinversion principle developed by Scharf.[14] As most encountered reactions are enthalpy dominated, the general opinion presumes that the lower the temperature is, the higher the stereoselectivity will be. However the opposite relation may also be true if the reaction is entropy dominated. This phenomenon is related to the reaction intermediates which may adopt different conformations, determined by enthalpy and entropy factors, leading to diastereomeric products. In our case, chelated or nonchelated species might be involved according to the temperature. Scharf has introduced the notion of isoinversion temperature as a frontier between the two regions. At the isoinversion temperature, the diasteroselectivity is the highest. Below this temperature, the diastereoselectivity increases with the temperature while the reverse relation is observed at temperatures higher than the isoinversion temperature. According to Table 1, the isoinversion temperature of the

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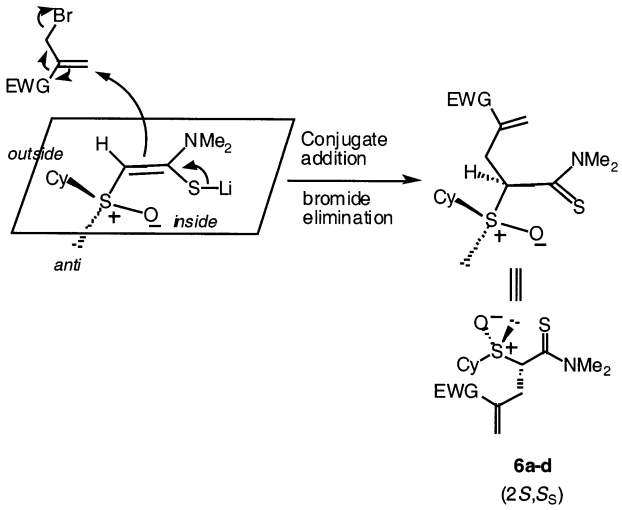
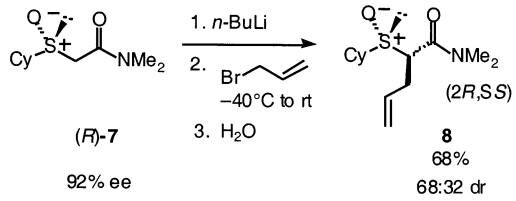
SCHEME 3



6a-d
(2*S*,S_S)

SCHEME 4



formation of **6b** would lie between 20 and 60 °C and that of the formation of **6c** would be higher than 0 °C.

As indicated above, the configuration of **6a** and of the major isomer of **6b**−**d** was assigned as (2*S*,S_S). The stereochemical outcome of the reaction can be explained by an electronic control that prevails over steric control by analogy with the model that we proposed for the Claisen rearrangement[5,8] and in agreement with the π-facial stereoselection demonstrated by Fujita for the electrophilic addition reactions to vinylic sulfoxides (Scheme 3).[2]

The best donor substituent, that is the lone pair of the sulfinyl moiety, is oriented anti to maximize $\sigma-\pi$ overlap that increases the energy level of the alkene HOMO. The most electron-withdrawing group, that is the oxygen atom, is placed at the *inside* allylic position to minimize the $\sigma^*-\pi$ overlap that decreases the HOMO energy level. To optimize the electronic transfer, the electrophile approach is antiperiplanar to the lone pair leading preferentially to the (2*S*,S_S) diastereomer of the thioamides **6a**−**d**.

Interestingly, the allylation of α-cyclohexylsulfinyl acetamide **7** (Scheme 4) proceeded with a lower selectivity (36% de) and, to our surprise, in favor of the (2*R*,S_S) diastereomer of amide **8**, suggesting that the steric control is more significant in the oxygen series.

In summary, efficient 1,2-asymmetric induction by a cyclohexylsulfinyl group was achieved through the allylation of a thioacetamide enolate with allyl halides possessing an electron-withdrawing group at the vinylic position. The reaction was fast at low temperature, and isoinversion was observed. We propose that a direct *C*-allylation has taken place, but an *S*-allylation followed by Claisen rearrangement cannot be ruled out. It led to α-sulfinyl γ-unsaturated thioamides **6**. Compounds **6** are highly functionalized molecules and versatile synthons as the thiocarbonyl moiety may be converted into various sulfur-free functional groups such as carbonyl or alkoxycarbonyl groups.[5,12,15] Work is underway to use the stereogenic sulfinyl group once more to create a C−C bond, and to eliminate the chiral auxiliary as late as possible.

Experimental Section

General Information. Solvents were dried immediately prior use. Dry THF was distilled from sodium/benzophenone under N_2. Commercial reagents were used directly as received. All reactions were monitored by TLC carried out on analytical silica gel TLC plates purchased from Merck silica gel and visualized with UV light and iodine. Preparative flash liquid chromatography was performed with Merck 60 silica gel (63−200 μm) in the eluting solvents indicated below. ^{1}H NMR spectra were recorded on a 250-MHz spectrometer. ^{13}C NMR spectra were determined with the same spectrometer operating with broad-band ^{1}H decoupling. Elemental analyses were performed by the Service central d'Analyse of CNRS at Vernaison or by the "Service d'Analyse de l'ICSN-CNRS" at Gif sur Yvette for C, H, N, and O or by LCMT for C, H, S, N, and O. Melting points are uncorrected.

Thioamides 6a−d. Only the signals of the minor isomer which were clearly identified are given. The (2*S*,S_S) configuration of **6a** and that of the major isomer of **6b**−**d** was deduced from that of the minor isomer of **6c**.

Typical Procedure. (*R*)-2-Cyclohexylsulfinyl-*N*,*N*-dimethylethanethioamide (**1**, 1 equiv) was diluted in freshly distilled THF (2 mL) and a 1.5 M solution of *t*-BuLi in pentane (1.05 equiv, except for carboxylic acid **6a** for which 2.1 equiv were used) was slowly added at −40 °C under nitrogen. After 1 h of stirring at −40 °C, the reaction mixture was allowed to warm to 0 °C then it was brought to a specific temperature and a solution of allyl halides **5a**−**d** (1.1 equiv) in THF (1 mL) was added. The reaction was monitored by TLC. After completion, the reaction mixture was hydrolyzed at 0 °C (5 mL) except for **6d**. The aqueous phase was acidified with diluted sulfuric acid and extracted with CH_2Cl_2 (3 × 5 mL). The combined organic layers were washed with water (5 mL), dried over $MgSO_4$, then concentrated to dryness for analysis.

(2*S*,S_S)-2-{[2-Cyclohexylsulfinyl]-2-(*N*,*N*-dimethylcarbamoyl)ethyl}prop-2-enoic Acid (6a). 6a was prepared from (*R*)-**1** (230 mg, 1 mmol) and 2-(bromomethyl)acrylic acid (**5a**, 182 mg, 1.1 mmol). **5a** was added at −40 °C then the temperature was increased to room temperature within 90 min. Flash chromatography on silica gel (ethyl acetate) afforded 132 mg (42% yield, dr 100:0) of **6a** as a yellow solid. Mp 124 °C; $[\alpha]^{21}_D$ −318 (*c* 1, $CHCl_3$); ^{1}H NMR (250 MHz, $CDCl_3$) δ 1.15−2.05 (m, 10H; 5 CH_2), 3.05−3.20 (m, 2H; CH_2 and C*H* of Cy), 3.35−3.50 (m, 1H; CH_2), 3.40 (s, 3H; NCH_3), 3.45 (s, 3H; NCH_3), 4.95−5.02 (m, 1H; SOC*H*), 5.81 (s, 1H; CH_2=), 6.27 (s, 1H; CH_2=); ^{13}C NMR (62.9 MHz, $CDCl_3$) δ 23.1, 25.2, 25.5, 25.9, 28.4 (5 *C*H_2), 36.5 (*C*H_2), 42.0, 43.8 (N(*C*H_3)$_2$), 55.2 (*C*H of Cy), 66.1 (SO*C*H), 129.8 (*C*H_2=), 135.7 (*C*=), 169.1 (*C*=O), 196.3 (*C*=S); IR (KBr) ν 2930, 2854, 1690, 1524, 1002, 982 cm^{-1}; MS (70 eV, EI) *m*/*z* (%) 318 (MH^+, 71), 247 (27), 188 (100), 133 (44), 83 (9); HRMS found 317.1201, $C_{14}H_{23}NO_3S_2$ (M^+) requires 317.1119. Anal. Calcd for $C_{14}H_{23}NO_3S_2$: C, 52.98; H, 7.31; N, 4.42; O, 15.13; S, 20.16. Found: C, 52.83; H, 7.37; N, 4.37; O, 14.93; S, 19.99.

(2*S*,S_S)-Methyl 2-{[2-Cyclohexylsulfinyl]-2-(*N*,*N*-dimethylcarbamoyl)ethyl}prop-2-enoate (6b). 6a was prepared from (*R*)-**1** (99 mg, 0.43 mmol) and methyl 2-(bromomethyl)-propenoate (**5b**, 85 mg, 0.47 mmol). **5b** was added at 20 °C and the reaction mixture was stirred for 10 min at room temperature.

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Flash chromatography on silica gel (ethyl acetate) afforded 81 mg (57% yield, dr 97:3) of **6b** as a yellow oil. (2*S*,S_S)-**6b** (96% de) was obtained after flash chromatography on silica gel (ethyl acetate). Its enantiopurity (96% ee) was measured by HPLC on a Chiralpack AD Daicel column (*n*-hexane/*i*-PrOH 85:15, λ = 282.1 nm). $[\alpha]^{21}_D$ −230 (*c* 0.5, $CHCl_3$); ^{1}H NMR (250 MHz, $CDCl_3$) δ 1.10−2.05 (m, 10H; 5 CH_2), 2.79−2.97 (m, 1H; C*H* of Cy), 3.10−3.24 (m, 1H; CH_2), 3.35−3.54 (m, 1H; CH_2), 3.33 (s, 3H; NCH_3), 3.43 (s, 3H; NCH_3), 3.76 (s, 3H; CO_2CH_3), 4.46 (dd, *J* = 5.0 Hz, *J* = 8.8 Hz, 1H; SOC*H*), 5.85 (s, 1H; CH_2═), 6.24 (s, 1H; CH_2═); ^{13}C NMR (62.9 MHz, $CDCl_3$) δ 22.9, 24.4, 25.4, 26.0, 28.4 (5 *C*H_2), 34.6 (*C*H_2), 41.9, 44.0 (N(*C*H_3)$_2$), 52.2 (O*C*H_3), 55.3 (*C*H of Cy), 66.4 (SO*C*H), 129.9 (*C*H_2═), 135.3 (*C*═), 167.4 (*C*═O), 196.4 (*C*═S); IR (NaCl) ν 2932, 2856, 1716, 1518, 1444, 1394, 1296, 1272, 1198, 1142, 1040 cm^{-1}; MS (70 eV, EI) *m*/*z* (%) 332 (MH^+, 1), 284 (1), 272 (3), 248 (19), 200 (76), 168 (21), 140 (73), 88 (30), 83 (100), 55 (100), 44 (30). ^{1}H NMR signals of the (2*R*,S_S) minor isomer (250 MHz, $CDCl_3$) δ 3.33 (s, 3H; NCH_3), 3.51 (s, 3H; NCH_3), 3.78 (s, 3H; CO_2CH_3), 5.01 (dd, *J* = 3.4 Hz, *J* = 10.7 Hz, 1H; SOC*H*), 5.86 (s, 1H; CH_2═), 6.21 (s, 1 H; CH_2═).

(2*S*,S_S)-4-Cyano-2-cyclohexylsulfinyl-*N*,*N*-dimethylpent-4-enethioamide (6c). 6c was prepared from (*R*)-**1** (93 mg, 0.4 mmol) and 2-(bromomethyl)acrylonitrile (**5c**, 73 mg, 0.5 mmol). **5c** was added at 0 °C and the reaction mixture was stirred for 10 min. Flash chromatography on silica gel (ethyl acetate) afforded 90 mg of **6c** as a yellow solid (76% yield, dr 95:5). Both isomers were separated by flash chromatography on silica gel (ethyl acetate). The (2*R*,S_S) configuration of the minor isomer was assigned by X-ray crystallographic analysis. The enantiopurity (98% ee) of the (2*S*,S_S) major isomer (100% de) was measured by HPLC on a Chiralpack AD Daicel column (*n*-hexane/*i*-PrOH 90:10, λ = 284.0 nm). Mp 79 °C; $[\alpha]^{21}_D$ −299 (*c* 1.25, $CHCl_3$); ^{1}H NMR (250 MHz, $CDCl_3$) δ 1.10−2.10 (m, 10H; 5 CH_2), 2.65−2.75 (m, 1H; C*H* of Cy), 3.26−3.45 (m, 2H; CH_2), 3.47 (s, 3H; NCH_3), 3.48 (s, 3H; NCH_3), 4.39 (dd, *J* = 4.2 Hz, *J* = 10.5 Hz, 1H; SOC*H*), 5.96 (s, 1H; CH_2═), 5.97 (s, 1H; CH_2═); ^{13}C NMR (62.9 MHz, $CDCl_3$) δ 23.1, 25.3, 25.4, 26.0, 28.6 (5 *C*H_2), 37.5 (*C*H_2), 42.4, 44.4 (N(*C*H_3)$_2$), 55.4 (*C*H of Cy), 65.9 (SO*C*H), 118.1 (*C*N or *C*═), 118.2 (*C*N or *C*═), 135.2 (*C*H_2═), 194.6 (*C*═S); IR (KBr) ν 3418, 2932, 2854, 2222, 1518, 1448, 1394, 1038 cm^{-1}; MS (70 eV, EI) *m*/*z* (%) 298 (M^+, 1), 247 (2), 167 (58), 83 (100), 69 (20), 55 (98), 44 (96). Anal. Calcd for $C_{14}H_{22}N_2OS_2$: C, 56.35; H, 7.44; N, 9.39; S, 21.45. Found: C, 56.72; H, 7.42; N, 9.50; S, 21.32. ^{1}H NMR signals of the (2*R*,S_S) minor isomer (250 MHz, $CDCl_3$) δ 1.10−2.10 (m, 10H; 5 CH_2), 2.70−2.87 (m, 1H; C*H* of Cy), 3.26−3.45 (m, 2H; CH_2), 3.44 (s, 3H; NCH_3), 3.48 (s, 3H; NCH_3), 4.76 (dd, *J* = 3.1 Hz, *J* = 11.0 Hz, 1H; SOC*H*), 5.88 (s, 2H; CH_2═); ^{13}C NMR of the (2*R*,S_S) minor isomer (62.9 MHz, $CDCl_3$) δ 21.7, 24.3, 24.4, 25.4, 27.6 (5 *C*H_2), 33.6 (*C*H_2), 41.6, 44.8 (N(*C*H_3)$_2$), 54.5 (*C*H of Cy), 61.3 (SO*C*H), 116.8 (*C*N or *C*═), 117.1 (*C*N or *C*═), 133.9 (*C*H_2═), 192.9 (*C*═S).

(2*S*,S_S)-2-Cyclohexylsulfinyl-4-(*tert*-butylsulfonyl)-*N*,*N*-dimethylpent-4-enethioamide (6d). 6d was prepared from (*R*)-**1** (101 mg, 0.43 mmol) and 3-bromo-2-(*tert*-butylsulfonyl)-propene (**5d**, 120 mg, 0.49 mmol). **5d** was added at −70 °C and the reaction mixture was stirred for 35 min then quenched at this temperature with a mixture of THF/water 1:1 (5 mL). Flash chromatography on silica gel (ethyl acetate/petroleum ether 1:1) afforded 117 mg of **6d** as a yellow solid (70% yield, dr 65:35). Crystallization (ethyl acetate/pentane) gave isomerically pure **6d** (100% de). Mp 110 °C, $[\alpha]^{19}_D$ −152 (*c* 1.16, $CHCl_3$); ^{1}H NMR (250 MHz, $CDCl_3$) δ 1.15−2.10 (m, 10H; 5 CH_2), 1.40 (s, 9H; (CH_3)$_3$), 2.68 (tt, *J* = 3.8 Hz, *J* = 11.9 Hz, 1H; C*H* of Cy), 3.32−3.57 (m, 2H; CH_2), 3.43 (s, 3H; NCH_3), 3.45 (s, 3H; NCH_3), 4.81 (dd, *J* = 4.1 Hz, *J* = 10.6 Hz, 1H; SOC*H*), 6.15 (s, 1H; C*H*═), 6.22 (s, 1H; C*H*═); ^{13}C NMR (62.9 MHz, $CDCl_3$) δ 23.2 ((*C*H_3)$_3$), 22.4, 25.4, 25.9, 28.2 (5 *C*H_2), 36.1 (*C*H_2), 42.7, 44.4 (N(*C*H_3)$_2$), 56.1 (*C*H of Cy), 61.0 (*C*(CH$_3$)$_3$), 66.3 (SO*C*H), 134.2 (*C*H_2═), 142.5 (*C*═), 195.8 (*C*═S); IR (KBr) ν 3424, 2934, 2856, 1520, 1454, 1394, 1286, 1100, 1042 cm^{-1}; MS (70 eV, EI) *m*/*z* (%) 394 (MH^+, 4), 264 (18), 247 (18), 189 (29), 147 (22), 133 (100), 83 (7). Anal. Calcd for $C_{17}H_{31}NO_3S_3$: C, 51.89; H, 7.95; N, 3.56; S, 24.40. Found: C, 51.82; H, 7.88; N, 3.65; S, 24.07. ^{1}H NMR signals of the (2*R*,S_S) minor isomer (250 MHz, $CDCl_3$) δ 1.15−2.10 (m, 10H; 5 CH_2), 1.39 (s, 9H; (CH_3)$_3$), 2.78 (tt, *J* = 3.5 Hz, *J* = 11.8 Hz, 1H; C*H* of Cy), 3.32−3.57 (m, 2H; CH_2), 3.45 (s, 3H; NCH_3), 3.54 (s, 3H; NCH_3), 5.20 (dd, *J* = 2.8 Hz, *J* = 10.9 Hz, 1H; SOC*H*), 6.15 (s, 1H; CH_2═), 6.26 (s, 1H; CH_2═); ^{13}C NMR signals of the (2*R*,S_S) minor isomer (62.9 MHz, $CDCl_3$) δ 21.1, 25.5, 26.2, 28.4 (4 *C*H_2), 33.9 (*C*H_2), 42.7, 45.7 (N(*C*H_3)$_2$), 55.7 (*C*H of Cy), 60.4 (*C*(CH$_3$)$_3$), 63.5 (SO*C*H), 134.0 (*C*H_2═), 141.8 (*C*═), 195.2 (*C*═S).

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Supporting Information Available: X-ray crystallographic data of (2*R*,S_S)-**6c** and HPLC chromatograms of **6b**,**c**. This material is available free of charge via the Internet at http://pubs.acs.org.

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