Synthesis of $[(\mu\text{-RS})Fe_2(CO)_6](\mu_4\text{-S})[(\mu\text{-R}'S)Fe_2(CO)_6]$ and $[(\mu\text{-t-BuS})Fe_2(CO)_6](\mu_4\text{-Se})[(\mu\text{-PhSe})Fe_2(CO)_6]$ via Reactions of $(\mu\text{-RS})(\mu\text{-}p\text{-MeC}_6H_4SO_2S)Fe_2(CO)_6$ with Nucleophiles. Crystal Structure of $[(\mu\text{-t-BuS})Fe_2(CO)_6](\mu_4\text{-S})[(\mu\text{-PhC}{\equiv}CS)Fe_2(CO)_6]$

Li-Cheng Song,*,† Xiang-Dong Qin,† Qing-Mei Hu,† and Xiao-Ying Huang‡

Department of Chemistry, Nankai University, Tianjin 300071, China, and State Key Laboratory of Structural Chemistry, Fuzhou, Fujian 350002, China

Received April 3, 1998

*Summary: A new synthetic route to μ_4-E (E = S, Se) twin clusters has been discovered, which involves reactions of $(\mu\text{-RS})(\mu\text{-}p\text{-MeC}_6H_4SO_2S)Fe_2(CO)_6$ with nucleophiles $(\mu\text{-R}'S)(\mu\text{-XMgS})Fe_2(CO)_6$ and $(\mu\text{-PhSe})(\mu\text{-BrMgSe})Fe_2(CO)_6$ to give the twin clusters $[(\mu\text{-RS})Fe_2(CO)_6](\mu_4\text{-S})[(\mu\text{-R}'S)Fe_2(CO)_6]$ (**5a**, R = R′ = Et; **5b**, R = Et, R′ = PhC_2; **5c**, R = t-Bu, R′ = Me; **5d**, R = t-Bu, R′ = Ph) and $[(\mu\text{-t-BuS})Fe_2(CO)_6](\mu_4\text{-Se})[(\mu\text{-PhSe})Fe_2(CO)_6]$ (**6**) characterized by combustion analysis, spectroscopy, and (for **5b**) X-ray diffraction techniques.*

Introduction

In a previous paper,[1] we reported that the $[Et_3NH]^+$ salts of sulfur-centered anions $[(\mu\text{-RS})(\mu\text{-S}^-)Fe_2(CO)_6]$ (**1**) reacted with *p*-toluenesulfonyl chloride to give the expected $(\mu\text{-RS})(\mu\text{-}p\text{-MeC}_6H_4SO_2S)Fe_2(CO)_6$ (**2**) and unexpected symmetrical μ_4-S twin clusters $[(\mu\text{-RS})Fe_2(CO)_6]_2(\mu_4\text{-S})$ (**3**). In that paper, we also suggested that the unexpected compounds **3** were possibly produced through nucleophilic attack of the negatively charged sulfur atom of **1** at one of the iron atoms of **2**, followed by coordination of the sulfur atom to another iron atom of **2** and concomitant loss of the ligand $SSO_2C_6H_4Me\text{-}p$, as shown in Scheme 1.

To justify the suggested mechanism for formation of **3** and to develop a new synthetic method for corresponding μ_4-E (E = S, Se) twin clusters, we recently studied the reaction of **2** with nucleophiles $[(\mu\text{-R}'S)(\mu\text{-S}^-)Fe_2(CO)_6][MgX]^+$ and $[(\mu\text{-PhSe})(\mu\text{-Se}^-)Fe_2(CO)_6][MgBr]^+$. Herein we report our results.

Results and Discussion

At the beginning of this study, we thought that if the suggested mechanism for formation of **3** in the reaction shown in Scheme 1 was correct, the reaction of **2** with $[MgX]^+$ salts of the sulfur-centered anions $[(\mu\text{-R}'S)(\mu\text{-S}^-)Fe_2(CO)_6][MgX]^+$ (**4**) would give symmetrical (R = R′) and asymmetrical (R ≠ R′) μ_4-S twin clusters $[(\mu\text{-RS})Fe_2(CO)_6](\mu_4\text{-S})[(\mu\text{-R}'S)Fe_2(CO)_6]$ (**5**). Now, this mechanism seems to be correct since our experiments showed that an equimolar amount of **2** reacted with **4** (prepared from $\mu\text{-S}_2Fe_2(CO)_6$ and Grignard reagents R′MgX)[2,3] in THF from −78 °C to room temperature to afford clusters **5**, as shown in Scheme 2.

It is worth pointing out that the reaction of **2** with **4** shown in Scheme 2 provides another new synthetic method for production of symmetrical and asymmetrical μ_4-S twin clusters.[1,3,4] In view of the nucleophilic similarity of the bridged sulfur-centered anions such as in salts **4** with their selenium analogues, it might be expected that reaction of **2** with bridged selenium-centered anions would produce corresponding μ_4-Se twin clusters.[1,5] This has been proved to be true by our experiment, that is, the reaction of **2** (R = t-Bu) with the $[MgBr]^+$ salt of the bridged selenium-centered anion $[(\mu\text{-PhSe})(\mu\text{-Se}^-)Fe_2(CO)_6]$ (prepared from $\mu\text{-Se}_2Fe_2(CO)_6$ and PhMgBr)[1] in THF, from −78 °C to room temperature to afford the μ_4-Se twin cluster $[(\mu\text{-t-BuS})Fe_2(CO)_6][(\mu_4\text{-Se})(\mu\text{-PhSe})Fe_2(CO)_6]$ (**6**), as shown in Scheme 3.

Interestingly, although some methods are known for preparation of μ_4-Se twin clusters,[1,5] there has been no method reported so far for making a type of μ_4-Se clusters that contain two different bridging ligands, such as μ-t-BuS and μ-PhSe in cluster **6**.

All products shown in Schemes 2 and 3, except **5a**,[3] are new and have been characterized by elemental analysis and spectroscopic methods. For example, for twin clusters **5b−d** and **6**, the IR spectra show three to four absorption bands in the range 2082−1983 cm^{-1} for their terminal carbonyls attached to iron atoms, in addition to the IR spectrum of **5b**, showing a weak absorption band at 2172 cm^{-1} for its C≡C triple bond. It is well-known that twin clusters **5b−d** and **6** could exist, on the basis of the steric repulsion grounds, as only one isomer in which the two substituents are bonded to the bridged S and Se atoms with an equatorial

---

[†] Nankai University.

[‡] State Key Laboratory of Structural Chemistry.

(1) Song, L.-C.; Yan, C.-G.; Hu, Q.-M.; Wang, R.-J.; Mak, T. C. W.; Huang, X.-Y. *Organometallics* **1996**, *15*, 1535.

(2) Seyferth, D.; Henderson, R. S.; Song, L.-C.; Womack, G. B. *J. Organomet. Chem.* **1985**, *292*, 9.

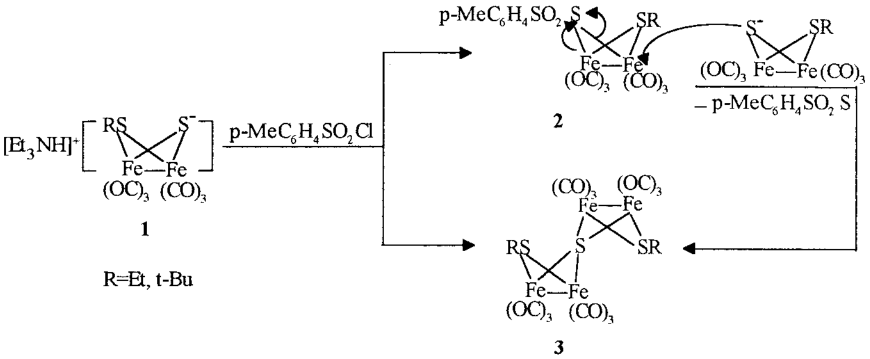
(3) Song, L.-C.; Kadiata, M.; Wang, J.-T.; Wang, R.-J.; Wang, H.-G. *J. Organomet. Chem.* **1988**, *340*, 239.

(4) Song, L.-C.; Hu, Q.-M.; Zhang, L.-Y.; Wang, H.; Zhou, Z.-Y.; Liu, L. *J. Organomet. Chem.* **1991**, *412*, C19.

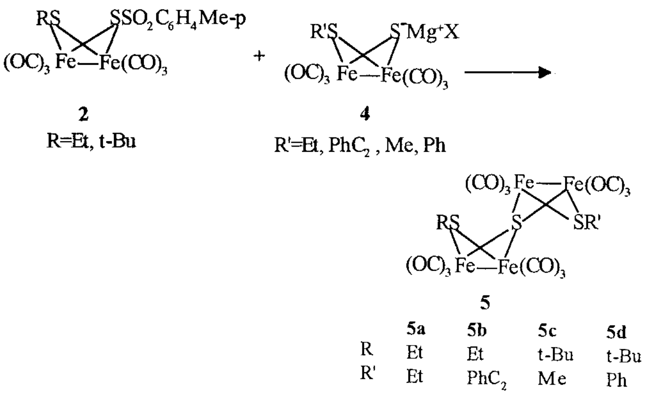
(5) (a) Song, L.-C.; Yan, C.-G.; Hu, Q.-M.; Huang, X.-Y. *J. Organomet. Chem.* **1995**, *505*, 119. (b) Mathur, P.; Trivedi, R.; Satyanarayana, C. V. V. *Organometallics* **1996**, *15*, 1062.

10.1021/om980254h CCC: $15.00 © 1998 American Chemical Society
Publication on Web 11/06/1998

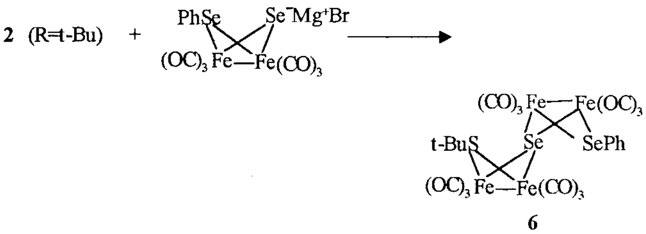
Scheme 1



Scheme 2



Scheme 3



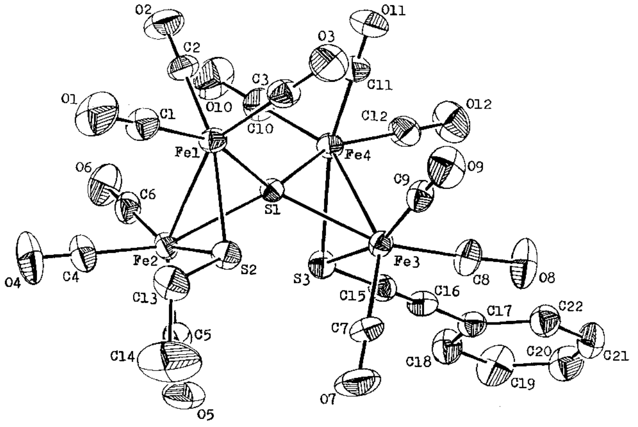


Figure 1.

Table 1. Selected Bond Lengths (Å) and Bond Angles (deg) for 5b

Fe(1)–S(1)	2.231(2)	Fe(1)–S(2)	2.252(2)
Fe(1)–Fe(2)	2.534(2)	Fe(2)–S(1)	2.240(2)
Fe(3)–S(1)	2.241(2)	Fe(3)–S(3)	2.282(1)
Fe(3)–Fe(4)	2.538(2)	Fe(4)–S(1)	2.226(2)
Fe(4)–S(3)	2.277(2)	C(15)–C(16)	1.83(6)
S(3)–C(15)	1.690(5)	C(16)–C(17)	1.440(6)
S(2)–C(13)	1.828(5)	C(17)–C(18)	1.372(7)
O(1)–C(1)	1.137(6)	O(3)–C(3)	1.34(6)
C(1)–Fe(1)–C(2)	91.2(3)	C(1)–Fe(1)–S(1)	157.7(2)
S(1)–Fe(1)–S(2)	76.52(6)	S(1)–Fe(1)–Fe(2)	55.65(5)
S(2)–Fe(1)–Fe(2)	56.15(5)	S(1)–Fe(2)–S(2)	76.06(6)
S(1)–Fe(2)–Fe(1)	55.32(5)	S(1)–Fe(3)–S(3)	76.63(6)
S(2)–Fe(2)–Fe(1)	55.63(5)	S(3)–Fe(3)–Fe(4)	56.07(5)
S(1)–Fe(3)–Fe(4)	55.10(5)	S(1)–Fe(4)–Fe(3)	55.65(5)
S(1)–Fe(4)–S(3)	77.03(7)	Fe(4)–S(1)–Fe(1)	132.61(7)
S(3)–Fe(4)–Fe(3)	56.27(5)	Fe(1)–S(1)–Fe(2)	69.03(6)
Fe(4)–S(1)–Fe(2)	136.83(6)		

type of bond.[1,3,5,6] This has been verified by their ^1H NMR spectra; that is, the Et group of **5b** displays one triplet at 1.39 ppm and one quartet at 2.49 ppm and the t-Bu group of **5c**,**d** and **6** shows one singlet between 1.44 and 1.52 ppm.

To further confirm the structures of this type of compound, a single-crystal X-ray diffraction analysis for the representative species **5b** was carried out. The molecular structure of **5b** is depicted in Figure 1, whereas the selected bond lengths and angles of **5b** are listed in Table 1. As can be seen from Figure 1, the twin cluster **5b** is indeed composed of (μ-EtS)$Fe_2(CO)_6$ and (μ-PhC≡CS)$Fe_2(CO)_6$ moieties joined to a spiran type of μ_4-S atom, which is very similar to other μ_4-S twin clusters such as [(μ-EtS)$Fe_2(CO)_6]_2(\mu_4$-S),[3] [(μ-n-BuS)$Fe_2(CO)_6](\mu_4$-S)[(μ-PhS)$Fe_2(CO)_6$],[7] and [(μ-MeS)-$Fe_2(CO)_6]_2(\mu_4$-S).[8] In **5b** the two Fe–Fe bond lengths (2.534(2), 2.538(2) Å) are very close to those of [(μ-EtS)-$Fe_2(CO)_6]_2(\mu_4$-S) (2.542(2), 2.538(2) Å)[3] and [(μ-n-BuS)-$Fe_2(CO)_6](\mu_4$-S)[(μ-PhS)$Fe_2(CO)_6$] (2.528(2), 2.517(9) Å).[7] The bond lengths between μ_4-S and the four iron atoms (2.226(2)-2.241(2) Å) in **5b** are also very close to those of [(μ-EtS)$Fe_2(CO)_6]_2(\mu_4$-S) (2.240(2)–2.254(2) Å)[3] and [(n-BuS)$Fe_2(CO)_6](\mu_4$-S)[μ-PhS)$Fe_2(CO)_6$] (2.240(1)–2.246(1) Å).[7] In fact, the other geometric features and parameters of these three μ_4-S twin clusters are all very close. However, for **5b**, it is worth pointing out that the bond angles of S(3)–C(15)–C(16) and C(15)–C(16)–C(17) are 177.9(5) and 178.3(5) Å and the bond length of C(15)–C(16) is 1.183(6) Å, both of which are consistent with the C(15)–C(16) bond being a C≡C triple bond. In addition, as seen intuitively from Figure 1, that the two substituents Et and PhC≡C are attached to bridged S(2) and S(3) atoms by an e-type of bond, that is, **5b** belongs to an e(Et)e(PhC≡C) isomer, which is in

---

(6) Shaver, A.; Fitzpatrick, P. J.; Steliou, K.; Butler, I. S. *J. Am. Chem. Soc.* **1979**, *101*, 1313.

(7) Song, L.-C.; Hu, Q.-M.; Jia, G.-F.; Wang, J.-Y. *Sci. China, Ser. B* **1992**, *35*, 1.

(8) Coleman, J. M.; Wojcicki, A.; Pollick, P. J.; Dahl, L. F. *Inorg. Chem.* **1967**, *6*, 1236.

good agreement with the assignment according to the ^{1}H NMR data mentioned above.

Experimental Section

All reactions were carried out under a highly purified nitrogen atmosphere using standard Schlenk and vacuum-line techniques. Tetrahydrofuran (THF) and diethyl ether were distilled from sodium−benzophenone ketyl, whereas triethylamine was distilled from KOH prior to use. Products were separated and purified using TLC glass plates (20 × 17 × 0.3 cm) covered with silica gel G (10−40 μm). Further purification of the products was by recrystallization from the mixed solvent CH$_2$Cl$_2$/petroleum ether. (μ-RS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$ (R = Et, t-Bu),[1] μ-S$_2$Fe$_2$(CO)$_6$,[9] μ-Se$_2$Fe$_2$(CO)$_6$,[10] RMgX (R = Et, Me, Ph),[11] and PhC≡CMgBr[12] were prepared according to literature methods. Elemental selenium was of commercial origin. IR spectra were recorded on a Nicolet FT-IR 5DX infrared spectrophotometer and ^{1}H NMR spectra on a JEOL FX 90 Q NMR spectrometer. C/H analyses and MS determinations were performed by using a 240C analyzer and HP 5988A spectrometer, respectively. Melting points were determined on a Yanaco MP-500 micro melting point apparatus.

Preparation of [(μ-EtS)Fe$_2$(CO)$_6$]$_2$ (μ_4-S) (5a). A 100 mL three-necked flask fitted with a magnetic stirbar, a rubber septum, and a nitrogen inlet tube was charged with 0.211 g (0.60 mmol) of μ-S$_2$Fe$_2$(CO)$_6$ and 30 mL of THF to form a red solution. The solution was stirred and cooled to −78 °C using a dry ice/acetone bath, and then a given amount of EtMgBr/Et$_2$O was slowly added until the solution turned green. To the green solution of (μ-EtS)(μ-BrMgS)Fe$_2$(CO)$_6$ was added 0.264 g (0.50 mmol) of (μ-EtS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$. The dry ice/acetone bath was removed, and the reaction mixture was stirred for 1 h at room temperature. Solvent was removed at reduced pressure, and the residue was subjected to TLC separation using petroleum ether as eluent. A main red band was developed with several tiny bands, and a large black band was left on the original spot, which was immovable even with CH$_2$Cl$_2$ as eluent. From the main red band was obtained 0.121 g (34%) of **5a** as a red solid, which has been identified by comparison of its IR and ^{1}H NMR spectra with those of an authentic sample.[3]

Preparation of [(μ-EtS)Fe$_2$(CO)$_6$](μ_4-S)[(μ-PhC≡CS)Fe$_2$(CO)$_6$] (5b). The same procedure was followed as that for **5a**, but a given amount of PhC≡CMgBr was used instead of EtMgBr. From the main red band was obtained 0.072 g (18%) of **5b** as a red solid, mp 112 °C (dec). Anal. Calcd for C$_{22}$H$_{10}$Fe$_4$O$_{12}$S$_3$: C, 33.62; H, 1.28. Found: C, 33.51; H, 1.40. IR (KBr disk): $\nu_{\text{C}\equiv\text{O}}$ 2082 (m), 2073 (s), 2041 (vs), 1991 (vs); $\nu_{\text{C}\equiv\text{C}}$ 2172 (w) cm^{-1}. ^{1}H NMR(CDCl$_3$): 1.39 (t, J = 7.2 Hz, 3 H, CH$_3$), 2.49 (q, J = 7.2 Hz, 2 H, CH$_2$), 7.24−7.40 (m, 5 H, C$_6$H$_5$) ppm. MS (EI; m/z (relative intensity)): 786 (M$^+$, 0.9), 730 (M$^+$ − 2CO, 1.6), 702(M$^+$ − 3CO, 3.0), 674(M$^+$ − 4CO, 2.1), 646(M$^+$ − 5CO, 2.7), 618(M$^+$ − 6CO, 5.3), 590(M$^+$ − 7CO, 8.2), 562 (M$^+$ − 8CO, 11.2), 534 (M$^+$ − 9CO, 18.3), 506 (M$^+$ − 10CO, 14.4), 478 (M$^+$ − 11CO, 20.0), 450 (M$^+$ − 12CO, 32.4), 320 (Fe$_4$S$_3$$^+$, 100).

Preparation of [(μ-t-BuS)Fe$_2$(CO)$_6$](μ_4-S)[(μ-MeS)Fe$_2$(CO)$_6$] (5c). The same procedure was followed as that for **5a**, but a given amount of MeMgI and 0.278 g (0.5 mmol) of (μ-t-BuS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$ were used instead of EtMgBr and (μ-EtS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$, respectively. From the main red band was obtained 0.079 g (22%) of **5c** as a red solid, mp 148 °C dec. Anal. Calcd for C$_{17}$H$_{12}$Fe$_4$O$_{12}$S$_3$: C, 28.05; H, 1.66. Found: C, 28.24; H, 1.69. IR (KBr disk): $\nu_{\text{C}\equiv\text{O}}$ 2082 (m), 2058 (s), 2041 (vs), 1991 (vs) cm^{-1}. ^{1}H NMR(CDCl$_3$): 1.45 [s, 9 H, C(CH$_3$)$_3$], 2.15 (s, 3 H, SCH$_3$) ppm. MS (EI; m/z (relative intensity)): 728 (M$^+$, 0.9), 672 (M$^+$ − 2CO, 1.9), 644 (M$^+$ − 3CO, 1.6), 616 (M$^+$ − 4CO, 3.1), 588 (M$^+$ − 5CO, 3.5), 560 (M$^+$− 6CO, 2.8), 532 (M$^+$ − 7CO, 8.8), 504 (M$^+$ − 8CO, 13.1), 476 (M$^+$ − 9CO, 23.4), 488 (M$^+$ − 10CO, 2.3), 420 (M$^+$ − 11CO, 15.6), 392 (M$^+$ − 12CO, 2.5), 320 (Fe$_4$S$_3$$^+$, 100).

Table 2. Crystal Data and Collection and Refinement Details for 5b

	5b
mol formula	C$_{22}$H$_{10}$Fe$_4$O$_{12}$S$_3$
mol wt	785.88
cryst syst	triclinic
space group	$P\bar{1}$ (No. 2)
a/Å	8.895(6)
b/Å	10.081(6)
c/Å	17.1513(5)
α/deg	95.35(4)
β/deg	104.36(4)
γ/deg	87.42(6)
V/Å^3	1483
Z	2
density (calcd)/g cm^{-3}	1.76
F(000)	780
μ(Mo Kα)/cm^{-1}	21.77
diffractometer	Enraf-Nonius CAD4
temp/°C	23
radiation	Mo Kα, λ = 0.710 69 Å
scan type	$\omega/2\theta$
$2\theta_{\text{max}}$/deg	50
R	0.039
R_{w}	0.051
goodness-of-fit indicator	1.44
max shift in final cycle	0.05
largest peak in final diff map/eÅ^{-3}	0.41

Preparation of [(μ-t-BuS)Fe$_2$(CO)$_6$](μ_4-S)(μ-PhS)Fe$_2$(CO)$_6$] (5d). The same procedure was followed as that for **5a**, but a given amount of PhMgBr and 0.278 g (0.50 mmol) of (μ-t-BuS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$ were used instead of EtMgBr and (μ-EtS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$, respectively. From the main red band was obtained 0.150 g (38%) of **5d** as a red solid, mp 162 °C dec. Anal. Calcd for C$_{22}$H$_{14}$Fe$_4$O$_{12}$S$_3$: C, 33.45; H, 1.79. Found: C, 33.16; H, 1.73. IR (KBr disk): $\nu_{\text{C}\equiv\text{O}}$ 2082 (m), 2041 (vs), 1991 (s) cm^{-1}. ^{1}H NMR (CDCl$_3$): 1.52 [s, 9 H, C(CH$_3$)$_3$], 7.32 (br, 5 H, C$_6$H$_5$) ppm. MS (EI; m/z (relative intensity)): 790 (M$^+$, 0.4), 734 (M$^+$ − 2CO, 1.3), 706 (M$^+$ − 3CO, 0.8), 678 (M$^+$ − 4CO, 1.8), 650 (M$^+$ − 5CO, 1.8), 622 (M$^+$ − 6CO, 3.3), 594 (M$^+$ − 7CO, 5.7), 566 (M$^+$ − 8CO, 5.9), 538 (M$^+$ − 9CO, 20.6), 510 (M$^+$ − 10CO, 3.9), 482 (M$^+$ − 11CO, 5.1), 454 (M$^+$ − 12CO, 16.3), 397 (C$_6$H$_5$Fe$_4$S$_3$$^+$, 17.9).

Preparation of [(μ-t-BuS)Fe$_2$(CO)$_6$](μ_4-Se)[(μ-PhSe)Fe$_2$(CO)$_6$] (6). The same procedure was followed as that for **5a**, but 0.437 g (1.0 mmol) of μ-Se$_2$Fe$_2$(CO)$_6$, a given amount of PhMgBr/Et$_2$O, and 0.820 g (1.49 mmol) of (μ-t-BuS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$ were used instead of μ-S$_2$Fe$_2$(CO)$_6$, EtMgBr, and (μ-EtS)(μ-p-MeC$_6$H$_4$SO$_2$S)Fe$_2$(CO)$_6$, respectively. From the main red band was obtained 0.543 g (61%) of **6** as a red solid, mp 112−114 °C dec. Anal. Calcd for C$_{22}$H$_{14}$Fe$_4$O$_{12}$SSe$_2$: C, 29.90; H, 1.60. Found: C, 30.02; H, 1.68. IR (KBr disk): $\nu_{\text{C}\equiv\text{O}}$ 2082 (s), 2032 (vs), 1983 (vs) cm^{-1}. ^{1}H NMR (CDCl$_3$): 1.51 [s, 9 H, C(CH$_3$)$_3$], 7.56 (br, 5 H, C$_6$H$_5$) ppm. MS (EI; m/z (relative intensity)): 634 (M$^+$ − 9CO, 9.9), 606 (M$^+$ − 10CO, 2.6), 578 (M$^+$ − 11CO, 6.4), 550 (M$^+$ − 12CO, 6.3), 416 (Fe$_4$Se$_2$S$^+$, 78.5).

Crystal Structure Determination of 5b. Single crystals of **5b** suitable for X-ray diffraction analysis were obtained by slow evaporation of its hexane solution. A single crystal measuring 0.90 × 0.50 × 0.42 mm was mounted on a glass fiber and placed in an Enraf-Nonius CAD4 diffractometer equipped with a graphite monochromator. Crystal data for **5b** are listed in Table 2.

---

[9] Bogan, L. E., Jr.; Lesch, D. A.; Rauchfuss, T. B. *J. Organomet. Chem.* **1983**, *250*, 429.

[10] Glidewell, C. *J. Organomet. Chem.* **1985**, *295*, 73.

[11] Gilman, H.; Zoellner, E. A.; Dickey, J. B. *J. Am. Chem. Soc.* **1929**, *51*, 1576.

[12] Danehy, J. P.; Killian, D. B.; Nieuwland, J. A. *J. Am. Chem. Soc.* **1936**, *55*, 611.

The structure of **5b** was solved by a direct method (MULTAN 82). The final refinements were accomplished by a full-matrix least-squares method with anisotropic thermal parameters for non-hydrogen atoms. All calculations were performed on a MICRO-VAX II computer by using the TEXSAN program system.

Acknowledgment. We are grateful to the National Natural Science Foundation of China, the State Key Laboratory of Structural Chemistry, and the Laboratory of Organometallic Chemistry for financial support of this work.

Supporting Information Available: Tables of data collection and processing parameters, positional and thermal parameters, bond lengths, and bond angles for **5b** (4 pages). Ordering information is given on any current masthead page.

OM980254H

Additions and Corrections

1997, Volume 16

Wolfgang Ahlers, Bodo Temme, Gerhard Erker,* Roland Fröhlich, and Frank Zippel: Formation, Structure, and Dynamic Behavior of a Novel Dinuclear Cationic μ-2,4-Hexadiyne Bis(zirconocene) Complex.

Page 1443. Reference 19 is incorrect. The correct literature citation is as follows.

(19) Strauss, D. A.; Zhang, C.; Tilley, T. D. *J. Organomet. Chem*. **1989**, *369*, C13.

OM980798J

10.1021/om980798j
Published on Web 11/03/98