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**Carbene complexes. Part 21. Synthesis and characterisation of bis(carbene)molybdenum(II) complexes and dimetal(0) complexes of the Group 6 elements containing novel bridging bis(carbene) ligands; X-ray structures of  $[\text{Mo}(\text{CO})_2(\text{L}^{\text{Et}})_2(\text{OSO}_2\text{CF}_3)_2][\text{L}^{\text{Et}}=\text{CN}(\text{Et})(\text{CH}_2)_2\text{NEt}]$  and  $[\text{W}(\text{CO})_5\{\text{C}(\text{OEt})\text{CH}_2\text{C}_6\text{H}_4\text{CH}_2\text{C}(\text{OEt})-\text{o}\}\text{W}(\text{CO})_5]$**

[David M. Anderson](#), [Garry S. Bristow](#), [Peter B. Hitchcock](#), [Hatam A. Jasim](#), [Michael F. Lappert](#) and [Brian W. Skelton](#)

## Abstract

Treatment of the bis(carbene)tetracarbonylmolybdenum (0) complex *cis*- $[\text{Mo}(\text{CO})_4(\text{L}^{\text{Et}})_2][\text{L}^{\text{Et}}=\text{[graphic omitted]Et}]$  with two equivalents of silver trifluoromethanesulphonate in tetrahydrofuran (thf) readily yields the molybdenum(II) complex  $[\text{Mo}(\text{CO})_2(\text{L}^{\text{Et}})_2(\text{OSO}_2\text{CF}_3)_2]$  (**1**). Reaction of the complexes  $[\text{M}(\text{CO})_6]$  (M = Cr or W) with  $\text{Mg}[(\text{CH}_2)_2\text{C}_6\text{H}_4-\text{o}](\text{thf})$  (M = Cr) or  $\text{o}-\text{C}_6\text{H}_4(\text{CH}_2\text{MgCl})_2$  (M = W) in thf affords the crystalline yellow  $\mu$ -bis(carbene)-dimetal(0) complex  $[\{\text{M}(\text{CO})_5\{\text{C}(\text{[graphic omitted]g}(\text{thf})_n\}[\text{M} = \text{Cr}, n = 3$  (**2a**); M = W,  $n = 4$  (**2b**)]], which when extracted into water and treated with  $[\text{Et}_3\text{O}][\text{BF}_4]$  furnishes the appropriate orange  $\mu$ -bis(carbene) bimetallic complex  $[\text{[graphic omitted]}(\text{OEt})\text{CH}_2\text{C}_6\text{H}_4\text{CH}_2\text{[graphic omitted]}(\text{CO})_5]$  [M = Cr (**3a**) or W (**3b**)]. Complex (**3a**) with an excess of  $\text{PEt}_3$  gives the red-orange complex  $[\{\text{[graphic omitted]}(\text{OEt})\text{CH}_2\text{C}_6\text{H}_4\text{CH}_2\text{[graphic omitted]}(\text{CO})_4(\text{PEt}_3)\}]$ . Reaction of  $[\text{M}(\text{CO})_6]$  with  $\text{o}-\text{C}_6\text{H}_4[\text{CH}(\text{SiMe}_3)\text{Li}(\text{tmen})]_2$  [tmen =  $\text{Me}_2\text{N}(\text{CH}_2)_2\text{NMe}_2$ ] yields  $[\text{[graphic omitted]}(\text{OEt})\text{CH}_2\text{C}_6\text{H}_4\text{CH}(\text{SiMe}_3)\text{C}_6\text{H}_4\text{CH}(\text{SiMe}_3)\text{[graphic omitted]}(\text{CO})_5]$ . In the crystalline bis(carbene)-molybdenum(II) complex (**1**), the Mo atom resides at the centre of a severely distorted octahedron  $[\text{C}_{\text{carb}}-\text{Mo}-\text{C}_{\text{carb}} 134.9(2)^\circ]$ , with the two five-membered  $\text{L}^{\text{Et}}$  rings arranged so as to be approximately parallel, and mean lengths  $\text{Mo}-\text{C}_{\text{carb}} 2.154(5)$ ,  $\text{Mo}-\text{CO} 1.961(6)$ , and  $\text{Mo}-\text{O} 2.177(4)\text{\AA}$ . In the crystalline ditungsten(0) complex (**3b**), each W is in an octahedral environment and selected mean parameters include  $\text{W}-\text{C}_{\text{carb}} 2.155(12)$ ,  $\text{W}-\text{CO} 2.03(4)$ , and  $\text{C}_{\text{carb}}-\text{O} 1.317(14)\text{\AA}$ .

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