

Organometallic Chemistry of Tungsten-Triosmium Cluster Compounds

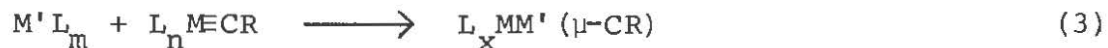
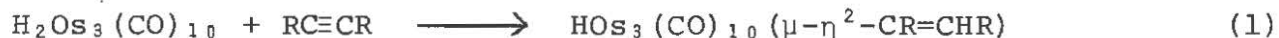
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The chemistry of transition metal cluster compounds has emerged over the last decade as one of the most rapidly expanding areas of organometallic chemistry [1]. This is in part due to a prospect that discrete cluster molecules may mimic metal surfaces in the processes of chemisorption and catalysis. Currently, mixed metal cluster compounds are under intense scrutiny since they have a number of advantages over their homonuclear counterparts [2]. The present study involves the synthesis, structure, and reactivity of several new tungsten-triosmium (WOs_3) cluster compounds. The presence of a tungsten atom in the cluster framework imparts a considerably different reactivity pattern than that observed in triosmium chemistry.

Since the unsaturated osmium cluster $\text{H}_2\text{Os}_3(\text{CO})_{10}$ and the "lightly stabilized" osmium complex $\text{Os}_3(\text{CO})_{10}(\text{NCMe})_2$ were reported, their reaction chemistry has been extensively examined. In particular, it has been shown that $\text{H}_2\text{Os}_3(\text{CO})_{10}$ undergoes facile insertion reactions with many alkynes ($\text{RC}\equiv\text{CR}$) to form alkenyl derivatives [3] (equation (1)), while $\text{Os}_3(\text{CO})_{10}(\text{NCMe})_2$ also reacts with alkynes to provide alkyne triosmium complexes [4] (equation (2)). Stone and coworkers have utilized the isolobal relationships between alkynes and metal alkylidyne complexes ($\text{L}_n\text{M}\equiv\text{CR}$) to prepare a series of mixed-metal μ -alkylidyne species [5] (equation (3)). The success of this idea has prompted a study of the two reactive triosmium clusters with a tungsten alkylidyne to form WOs_3 cluster compounds.



In contrast to the reaction with alkynes, however, a remarkably facile Os-Os bond cleavage has been observed in the reaction of $\text{H}_2\text{Os}_3(\text{CO})_{10}$ with $\text{Cp}(\text{CO})_2\text{W}\equiv\text{CTol}$ ($\text{Cp} = \eta^5\text{-C}_5\text{H}_5$, $\text{Tol} = p\text{-C}_6\text{H}_4\text{Me}$), giving three products by three parallel pathways: $\text{CpW}\text{Os}_3(\text{CO})_{11}(\mu_3\text{-}\eta^2\text{-C(O)CH}_2\text{Tol})$ (1), $\text{Cp}_2\text{W}_2\text{Os}(\text{CO})_7(\mu_3\text{-}\eta^2\text{-C}_2\text{Tol}_2)$ (2), and $\text{CpW}\text{Os}_3(\text{CO})_{10}(\mu_3\text{-CTol})_2\text{H}$ (3) [6]. Interestingly, the reaction of $\text{Os}_3(\text{CO})_{10}(\text{NCMe})_2$ with $\text{Cp}(\text{CO})_2\text{W}\equiv\text{CTol}$ gave a major product, $\text{CpW}\text{Os}_3(\text{CO})_{11}(\mu_3\text{-CTol})$ (4), in which the Os_3 skeleton remains intact.

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