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Preliminary communication

THE INTERACTION OF DIVALENT TIN COMPOUNDS WITH TRANSITION METAL CARBONYLS

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Summary

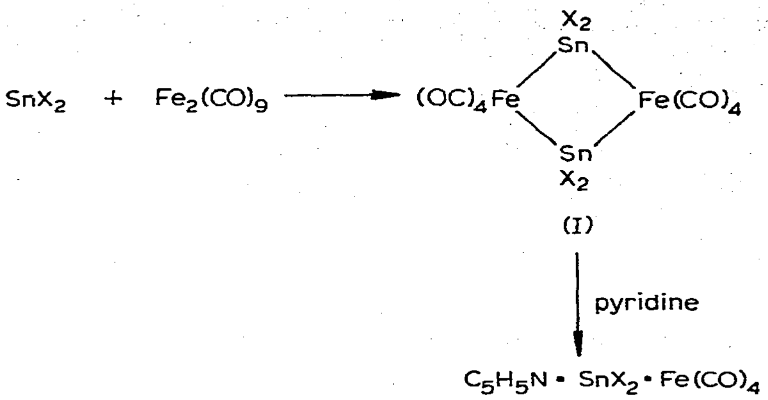
The reaction of tin(II) halides, cyclopentadienyls, and β-diketonates with $Co_2(CO)_8$, $Fe_2(CO)_9$, and Group VI metal carbonyls is described.

The recent reports of Lappert et al. [1] and Lindner et al. [2] concerning the isolation of Group VI metal pentacarbonyl derivatives of $[(Me_3Si)_2CH]_2Sn$ [1] and tin(II) halides [2] prompt us to communicate some of our own investigations into the interactions of divalent tin compounds with transition metal carbonyls.

In contrast to the quite rapid reaction between tin(II) halides and $Co_2(CO)_8$ in THF leading to carbenoid insertion into the Co—Co bond [3], the reaction of bis(methylcyclopentadienyl)tin with $Co_2(CO)_8$ is complex, $Sn[Co(CO)_4]_4$ being isolated in quite high yield after ca. two days.

The reaction of tin(II) halides with $Fe(CO)_5$ affords no characterisable products, but $Fe_2(CO)_9$ reacts smoothly with a wide range of tin(II) compounds, SnX_2, to give dimeric $[X_2SnFe(CO)_4]_2$ derivatives (I).

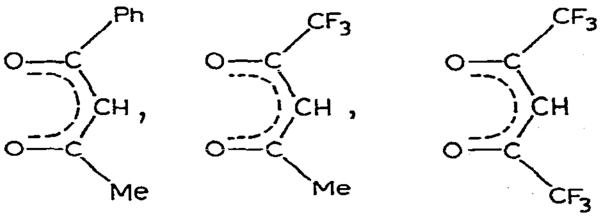
The derivatives I undergo base-induced homolytic ring fission to give the monomeric species II. Similar behaviour has been observed by Marks et al. [4] for the analogous $[R_2SnFe(CO)_4]_2$ (R = Me, t-Bu) derivatives. The change in coordination at iron in this process is elegantly monitored by iron-57 Mössbauer spectroscopy. The structure of I (X = Me) is known [5], and contains nearly octahedrally coordinated iron. Consistent with this arrangement of ligands about iron, the iron-57 Mössbauer spectra of the derivatives I consist of a single resonance due to the near cubic electric field at the metal, the electronegativities of the carbon and tin ligands not being sufficiently different to produce electronic imbalances in the σ-framework. On addition of base to the dimeric derivatives I, the stereochemistry at iron changes grossly from octahedral to five-coordinate trigonal bipyramidal, and thus inducing a quadrupole splitting of ca. 2 mm sec^{-1}; a value expected for the latter geometry.



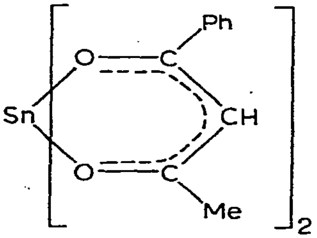
(I)

(II)

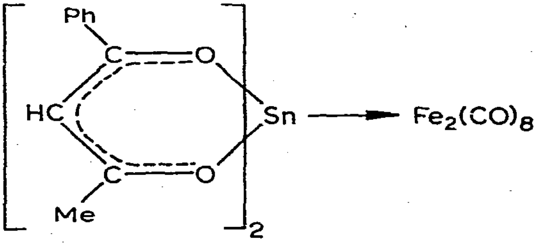
$X = Cl, Br, C_5H_5, MeC_5H_4,$



A second product was also obtained from the reaction of



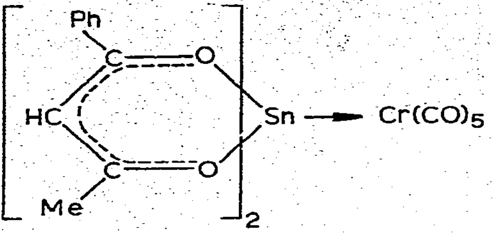
and $Fe_2(CO)_9$, which, on the basis of microanalytical and infrared data, appears to be the intermediate



in the formation of I ($X = O_2C_3HMePh$).

The reaction of SnX_2 ($X = C_5H_5$, MeC_5H_4) with $Cr(CO)_6$ does not proceed thermally. However, photolysis of tin(II) cyclopentadienyls or β-diketonates with Group VI metal carbonyls proceeds efficiently to give the corresponding $M(CO)_5$

complexes of the divalent tin ligand, for example $(C_5H_5)_2SnW(CO)_5$ and



can be isolated as brown and pale yellow powders, respectively.

Acknowledgements

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