Iron Pentacarbonyl – Fe(CO)₅

Compiled by Yoann Coquerel

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Abstracts

(A) Fe(CO)₅ and a catalytic amount of sodium borohydride react with cycloheptatrienes in protic solvents to yield the corresponding tricarbonyl(η⁵-1,3-diene)iron complexes in a one-pot procedure, which has been found to be particularly efficient for the synthesis of the useful tricarbonyl(cycloheptadiene)iron complex and, after oxidative removal of the iron moiety, of the cycloheptadiene itself.

(B) 5-Alkyl cyclohexenones of high enantiomeric purity can be obtained in good yields by ultraviolet irradiation of enantiomerically pure alkyl cyclopropanes in the presence of Fe(CO)₅. Given the many strategies for the preparation of enantiomerically pure alkyl cyclopropanes that are available, this promises to be a versatile method for the construction of cyclohexane derivatives.
(C) On irradiation in the presence of Fe(CO)$_3$, vinyl epoxides are readily transformed into (η$_5$-allyl)tricarbonyliron lactone complexes, which can be further transformed into the corresponding lactam complexes. Oxidative decomplexation of these iron complexes subsequently affords β- or δ-lactones and lactams. This method is of considerable value for natural product synthesis due to the number of methods available for the preparation of optically active epoxides.

(D) The iron-mediated [2+2+1] cycloaddition of diynes provides a broad scope of carbo- and heterobicyclic cyclopentadienones complexes which can be easily decomplexed and further manipulated for transformation in biologically active natural and non-natural products.

(E) The reactivity of the tricarbonyl(tropone)iron complex is a good example of both the protecting and stereodirecting properties of the tricarbonyl(η$_5$-1,3-diene)iron moiety. Indeed, this complex can undergo stereoselective Diels–Alder cycloadditions and 1,2 or 1,4 nucleophilic additions. Various other reactions can be achieved stereoselectively on the uncomplexed double bond.

(F) Upon treatment with the trityl cation, tricarbonyl(η$_5$-diene)iron complexes undergo hydride abstraction to give the corresponding η$_5$-dienyl complex, which react with nucleophiles to yield regio- and stereoselectively the 5-anti-substituted η$_5$-dienyl complex. It is the cyclohexadiene derivatives which have led to the largest number of applications (recent work includes the synthesis of carbazole alkaloids and carbom- and heterospirocyclic frameworks), but the cycloheptadiene derivatives also have proven to be very useful.

References


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