Organometallic Chemistry — lecture 1

direct M–C bond (± hydrides)

~~MOFs~~

$Ti(CH_3)_4$, $Cr(CO)_6$, Cp_2M (a 'metallocene'), RLi, RMgX, etc....

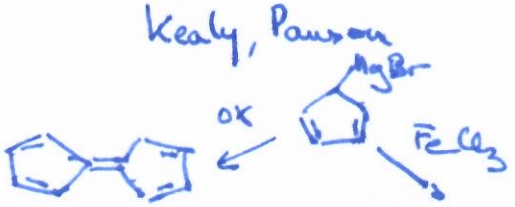
why?
- fundamental interest
- catalysis
- organic synthesis
- materials science – volatile CVD precursors
- biology (vitamin B_{12})

Zeise's salt:

$$KCl + PtCl_4 + CH_3CH_2OH \xrightarrow{\Delta} K[Pt(C_2H_4)Cl_3]$$

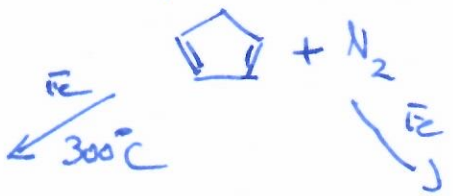
see: D. Seyferth Organomet. 2001, 20, 2

Kealy, Pauson



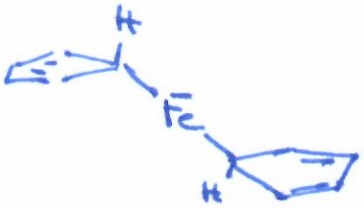
fulvalene $C_{10}H_{10}Fe$

Miller, Tebboth, Tremaine



Cp_2Fe, ferrocene.

G. Wilkinson JOMC 1975, 100, 273



m.p. 174°C, stable

stable in air, up to 500°C!

or in hot HCl

Wilkinson, Woodward, Rosenblum, Whiting

$(\eta^5\text{-}C_5H_5)_2Fe$

hapticity

a 'sandwich' compounds

M–R thermodynamically stable?

⇵ $\Delta H < 20$ kcal/mol

M + R· 'Case'

Kinetic instability (facile dec. pathways)

↓

β-H-eliminations

active field now:

- journals: Organometallics, JOMC
- books: Comp. Organomet. Chem
- ACS award: 2021 – Melanie Sanford
  Nobel: R. Heck

Predictor of stability → 18-electron rule

equivalent to octet rule

CH_4 ~~CH_5~~ ~~CH_3~~ , TM: s, p, d

$1 + 3 + 5 = 9 \times 2 = 18e$

a bit more: MO-Theory