B.Sc. Semester-IV
Core Course-VIII (CC-VIII)
Inorganic Chemistry

I. Coordination Chemistry

10. Metals in Low Oxidation States : CO as a Strong Ligand

Dr. Rajeev Ranjan
University Department of Chemistry
Dr. Shyama Prasad Mukherjee University, Ranchi

Coordination Chemistry: 20 Lectures

Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

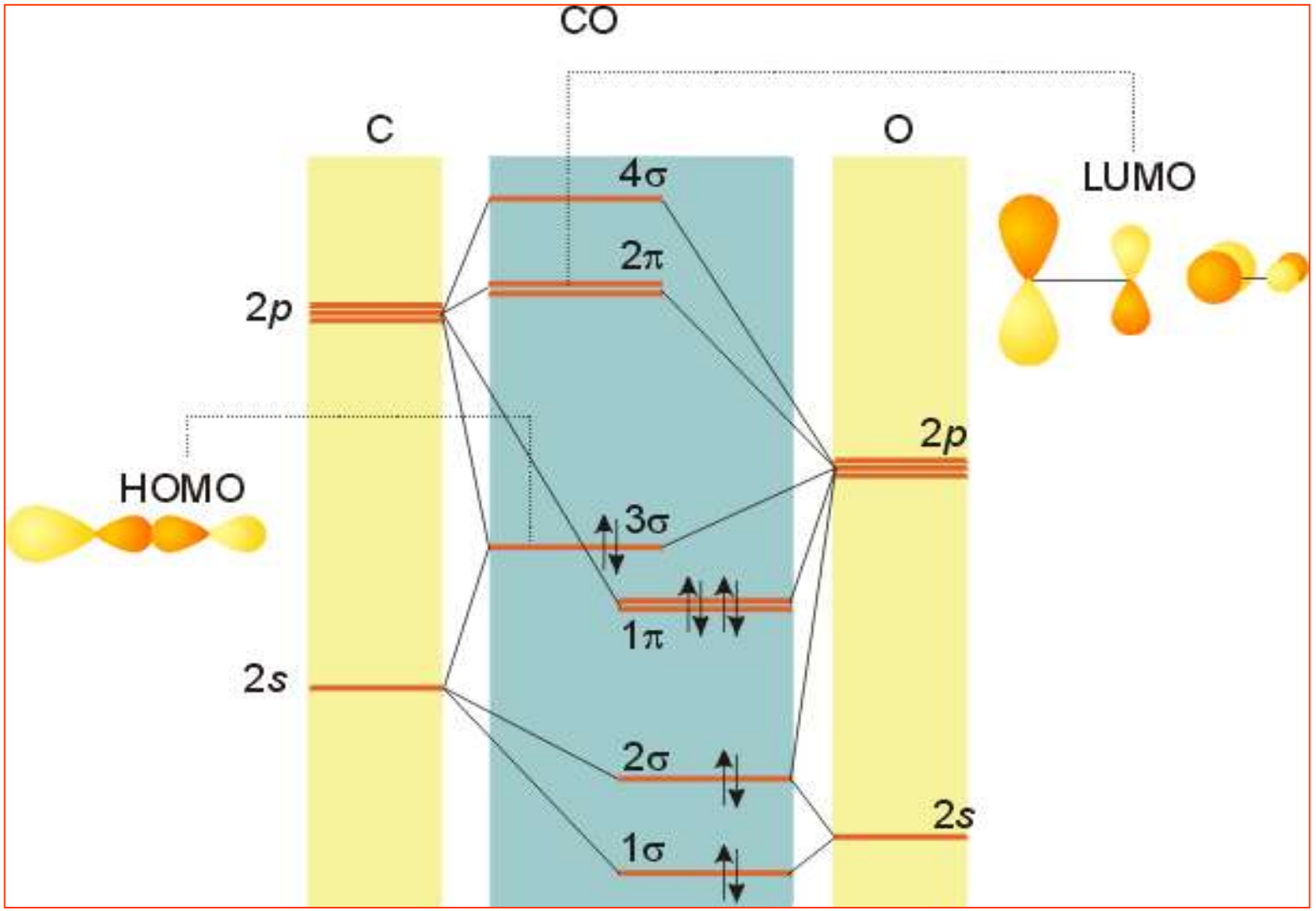
Coverage:

1. Metals in Low Oxidation States : CO as a Strong Ligand
2. Principle of Back Bonding

Metals in Low Oxidation States

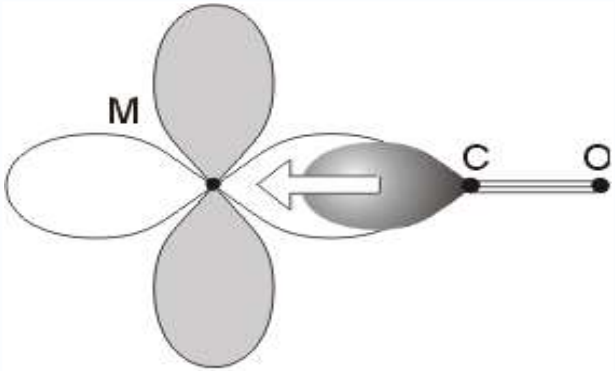
- **In low oxidation states, the electron density on the metal ion is very high.**
- **To stabilize low oxidation states, we require ligands, which can simultaneously bind the metal center and also withdraw electron density from it.**

Stabilizing Low Oxidation State: CO Can Do the Job

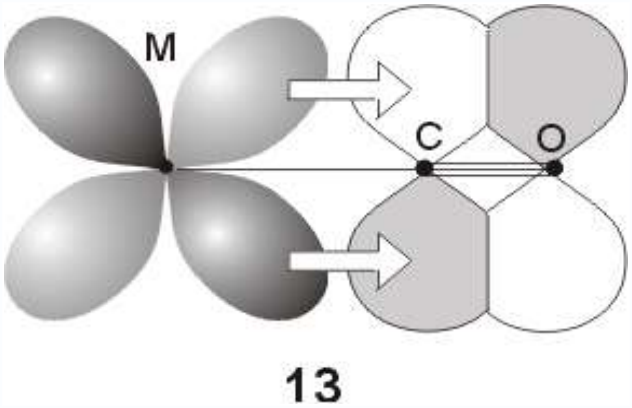


Dr. Rajeev Ranjan

Stabilizing Low Oxidation State: CO Can Do the Job

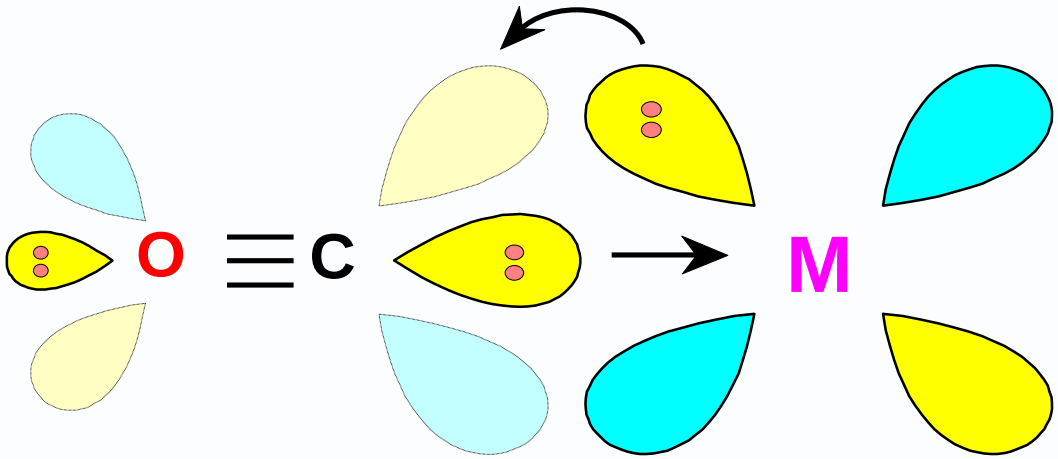


12

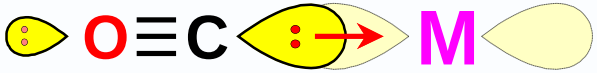


13

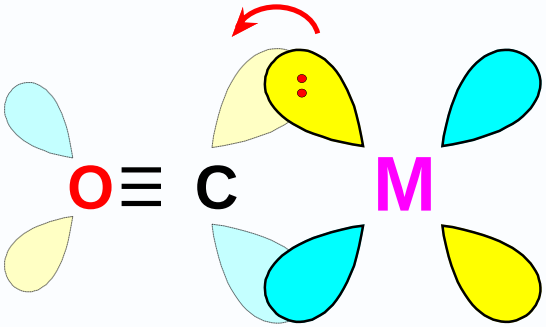
$Ni(CO)_4$], [$Fe(CO)_5$], [$Cr(CO)_6$], [$Mn_2(CO)_{10}$], [$Co_2(CO)_8$], $Na_2[Fe(CO)_4]$, $Na[Mn(CO)_5]$



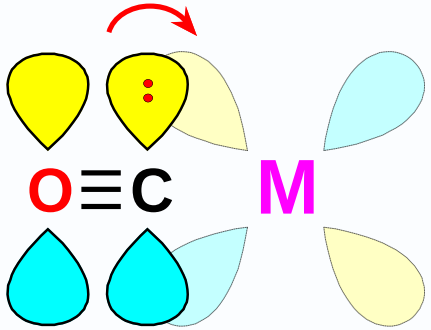
σ orbital serves as a very weak donor to a metal atom



CO-M sigma bond

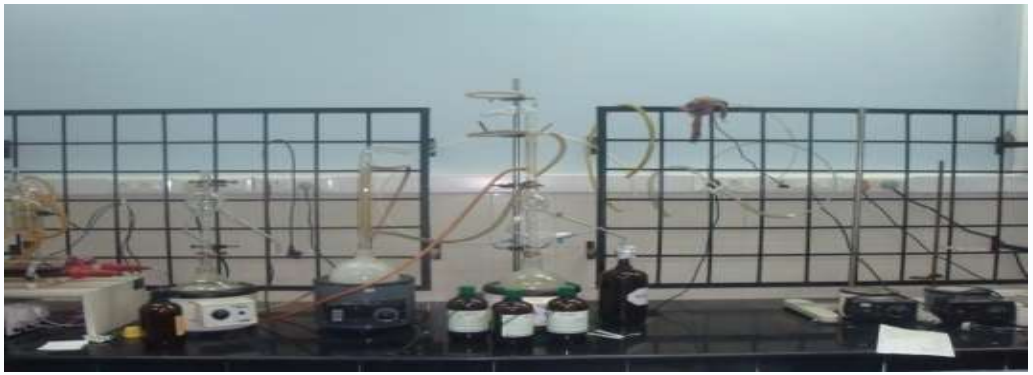


M to CO pi backbonding



CO to M pi bonding
(rare)

Thank You



Dr. Rajeev Ranjan
University Department of Chemistry
Dr. Shyama Prasad Mukherjee University, Ranchi