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Weblinks

- https://en.wikipedia.org/wiki/Pi_backbonding
- https://en.wikipedia.org/wiki/Orbital_overlap
- http://chem-faculty.lsu.edu/stanley/webpub/4571-chap10-MM-bonding.pdf
- https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry/Coordination_C hemistry_and_Crystal_Field_Theory
- https://organometallicchem.wordpress.com/tag/backbonding/
- http://science-blogs.ucoz.com/resources/notes/msc/theory/Coordination2.pdf

Chemistry	Paper 3: INORGANIC CHEMISTRY – I (Stereochemistry, Metal-
	Ligand Equilibria and Reaction Mechanism of Transition Metal
	Complexes)
	Module 3: dπ-pπ bonding



Suggested Readings

Fourth Edition	Inorganic chemistry: Principles of structure nad reactivity By James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi
Annual Constant Const	ala courses
	Inorganic chemistry
	Inorganic chemistry By Shriver, Weller, Overton, Rourke, Armstrong
Inorganic	Inorganic Chemistry
James E. House	By James E. House

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Glossary

A

Adduct- It is the product of a direct addition of two or more distinct molecules, resulting in a single reaction product containing all atoms of all components. The resultant is considered a distinct molecular species.

B

Backbonding- It is a concept from chemistry in which electrons move from an atomic orbital on one atom to π^* antibonding orbital on a π -acceptor ligand.

Borazine- It is an inorganic compound with the chemical formula (BH)₃(NH)₃. In this cyclic compound, the three BH units and three NH units alternate. The compound is isoelectronic and isostructural with benzene. Like benzene, it is also a colourless liquid. For this reason it is called inorganic benzene.

С

Covalent bonding: It is the most common type of metal-metal bonding. In this bond one electron is count from each metal center.

D

Dative bonding: In this type of bonding one metal make use of filled d orbital (lone pair) to coordinate to an empty orbital of the other metal. In most of the situations dative bonds are counted as covalent bonds.

H

Hybridisation- Hybridisation is the concept of mixing of atomic orbitals into new hybrid orbital(with different energies, shapes, etc. than the component atomic orbitals) suitable for the pairing of electrons to form chemical bonds.

L

Lewis acid- A compound or ionic species which can accept an electron pair from a donor compound.

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Lewis base- Lewis base is any species that donates a pair of electrons to lewis acid to form lewis adduct.

0

Orbital overlap- Orbital overlap is the concentration of orbitals on adjacent atoms in the same regions of space. Orbital overlap can lead to bond formation.

S

Symmetry bonding: This type of bonding is not common as it is a weak metal-metal interaction caused by molecular orbital symmetry interactions of filled and empty metal-metal bonding or/and antibonding orbitals. This type of bonding is found in metals having d⁸ configuration.

Do you know?

Backbonding in metal phosphine complexes

Phosphines accept electron density from metal p or d orbitals into combinations of P-C σ^* antibonding orbitals that have π symmetry. When phosphines bond to electron-rich metal atoms, backbonding would be expected to lengthen-C bonds as P-C σ^* orbitals become populated by electrons. The expected lengthening of the P-C distance is often hidden by an opposing effect: as the phosphorus lone pair is donated to the metal, P(lone pair)-R(bonding pair) repulsions decrease, which acts to shorten the P-C bond. The two effects have been deconvoulted by comparing the structures of pairs of metal-phosphine complexes that differ only by one electron. Oxidation of R₃P-M complexes results in longer M-P bonds and shorter P-C bonds, consistent with π -backbonding. In early work, phosphine ligands were thought to utilize 3d orbitals to form M-P π -bonding, but it is now accepted that d-orbitals on phosphorus are not involved in bonding as they are too high in energy.

Backbonding in metal carbonyls, nitrosyls and isocyanides

The electron are partially transferred from a d-orbitals of the metal to anti bonding molecular orbitals of CO (and it analogues). This electron transfer (i) strengthens the metal-C bond and (ii) weakens the C-O bond. The strengthening of the M-CO bond is reflected in increase of the vibrational frequencies for the M-C bond (often outside of the range for the usual IR spectrophotometers). Furthermore, the M-CO bond length is shortened. The weakening of the C-O bond is indicated by a decrease in the frequency of v_{CO} band from that of free CO (2143cm⁻¹), for example to 2060cm⁻¹ in Ni(CO)₄ and 1981cm⁻¹ in Cr(CO)₆ and 1790cm⁻¹ in the anion [Fe(CO)₄]²⁻. For this reason, IR spectroscopy is an important diagnostic technique in metal carbony chemistry.

Many ligands other than CO are strong "backbonders". Nitric oxide is an even stronger π -acceptor than is CO and v_{NO} is a diagnostic tool in metal-nitrosyl chemistry. Isocyanides,

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RNC, are another class of ligands that are able of π -backbonding. In contrast with CO, the σ donor lone pair on the C atom of isocyanides is antibonding in nature and upon complexation the CN bond is strengthened and v_{CN} increased. At the same time, π -backbonding lowers the v_{CN}. Other ligands have weak π -backbonding abilities, which creates a labilization effect CO, which is described by the cis effect.

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