

Metals and their Compounds

Lecture 8.3

Hard and soft ions and ligands

Hard - means small & non-deformable

Soft - means large and deformable

Hard metal ions:

Small (near top of Periodic Table) Li^+ Na^+ Ca^{2+}

highly charged Fe^{3+} Co^{3+} Cr^{3+} Al^{3+}

Soft metal ions:

Large (lower down in PT) Hg^{2+} Ag^+

Low charge Cu^+

Hard ligands:

Donor atom (one bonded to metal) is small O, N, F

Soft Ligands:

Donor atoms is large e.g. S, P, Br, I

Rule: HARD likes HARD : SOFT likes SOFT

Thiocyanate ion SCN^- ion has hard end (N) and soft end (S) so

$[\text{Ni}(\text{NCS})_4]^{2-}$ is N-bonded (Ni hard N hard)

$[\text{Pt}(\text{SCN})_4]^{2-}$ is S-bonded (Pt soft S soft)