School of Chemistry

Aims and Objectives: Session 2022-2023

Module CH4515: Advanced Main Group Chemistry

Duration: 20 hours

Lecturers: Dr P. Kilian* and Dr A. Stasch

(*Module Convenor)

Aims: To discuss the syntheses, structures, bonding modes and selected reactivity of a wide range of molecular main group element compounds from the s- and p-block, including low coordinate mono- and dinuclear species, ring and cage molecules, and main group cluster compounds. The bonding in the different compound classes will be presented and general rules for predicting their geometry will be introduced, e.g. for those of boranes and Zintl anions. Further advanced topics in s and p block chemistry will be introduced, for example the stabilization of heavier main group multiple bonds, low coordinate main group element centres, base stabilised low valent main group compounds, non-classical bonds, frustrated Lewis pairs and weakly coordinating anions.

Objectives:

1. To know basic electron counting rules for main group and transition metal clusters.
2. To recognise structural similarities of ring, cage and cluster compounds.
3. To know and understand properties and reactivities of selected main group compound classes.
4. To understand the differences and similarities of selected concepts used in organic, organometallic and main group inorganic chemistry.
5. To understand advanced bonding concepts in main group compounds, i.e. 3 center 2 electron, 3 center 4 electron and π^*- π^* bonding.
6. To recognise the importance of ligand properties and steric protection in the synthesis of low coordinate main group compounds including multiply bonded systems and to know the implications for their reactivity.
7. To know a wide range of contemporary chemical concepts and research topics based on compound classes spanning different groups of s- and p-block elements.
8. To understand the link between structure and bonding of various main group compound classes and their reactivity, including small molecule activation.