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# Main group element compounds in materials and catalysis

Selvarajan Nagendran, *[a] Ramaswamy Murugavel *[b] and Eric Rivard *[c]

It is our great pleasure to welcome the readers of *Dalton Transactions* to this themed web collection devoted to "Main group element compounds in materials and catalysis". This themed collection is also a tribute to the extraordinary contributions of Professor Vadapalli Chandrasekhar (often called VC or Chandra by his friends and colleagues), who is also an Associate Editor of *Dalton Transactions*.

The s- and p-block elements within the modern Periodic Table are referred to as the *main group* elements, and the chemistry of compounds formed by these elements has attracted chemists for a long time. While much of the developments during the last two centuries have focused on fundamental synthetic and structural aspects of new and increasingly unusual/exotic main group compounds, a tremendous surge has been witnessed in recent years concerning their use in applied materials chemistry and catalysis. This expansion of research scope is motivated by many factors associated with several main group elements, such as their abundance in the Earth's crust, low cost, and benign nature. The evolution of new strategies for kinetic stabilization, enhancing the Lewis acidity, and accessing various (lower) oxidation states of the main group elements, stand as pillars that support the growth and utility of this area of research.

Considering the above-mentioned aspects, it was deemed fitting to have a special issue in *Dalton Transactions* that would showcase recent advancements in the applications of main group element compounds, especially in relation to materials and catalysis. The topics covered include studies on small-molecule activation, low-valent main group chemistry, Lewis acidic compounds, single-molecule precursors for materials, and other advances involving main group elements.

This themed collection has gathered thirty-three articles covering a broad spectrum of achievements in the chemistry of main group element compounds. This collection consists of one perspective and one frontier article, six communications, and twenty-five research articles. The perspective article discusses inorganic aromatic rings obtained from amidinatosilylenes (Roesky and Kushvaha, https://doi.org/10.1039/D4DT02790F). Insights from the theoretical analyses of $CO_2$-capturing compounds through heteronuclear Al–M bonds (M = Fe, Cu, Ag, Au) are offered in the frontier article by Mankad and Supundrika Subasinghe (https://doi.org/10.1039/D4DT02018A).

The communications and research articles that deal with aspects of materials and catalysis are: (a) a report of the electronic structure, bonding, and magnetic anisotropy of dysprosium and terbium mononitrides, as well as their encapsulation in zig-zag boron nitride nanotubes (BNNTs), informed by cutting-edge computational techniques (Singh and co-workers, https://doi.org/10.1039/D4DT03311F), (b) demonstration of the *in situ* growth of octaphenyl polyhedral oligomeric silsesquioxane nanocages over multi-layered fluorinated graphene nanosheets (Datta, Shanmugan and co-workers, https://doi.org/10.1039/D4DT02678K), (c) attempts to photo-deposit Si and $Si_xGe_y$-type materials using oligomers of cyclogermapentenes and cyclosilapentenes (Rivard and co-workers, https://doi.org/10.1039/D4DT03446E), (d) synthesis of thermally stable energetic materials with decreased sensitivity based on 1,2,4-triazol-3-one and asymmetric *N*-methylene-C-linked nitropyrazoles (Kumar and co-workers, https://doi.org/10.1039/D4DT02494J), (e) preparation of a novel hybrid perovskite, ammonium halogenobismuthate, that shows ferro- and piezoelectric properties (Zaręba, Boomishankar and co-workers, https://doi.org/10.1039/D4DT03225J), (f) studies on the catalytic efficiency of indium(III) complexes for two distinct reactions: the multicomponent synthesis of 2-amino-4*H*-chromene derivatives and fixation of $CO_2$ (Pandey, Bhattacharya and co-workers, https://doi.org/10.1039/D4DT03382E), (g) oxidation of bis(3,6-di-*tert*-butyl-catecholato)silane to give a Lewis superacidic silylium ion radical that has considerable catalytic activity in

[a]*Department of Chemistry, Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110016, India. E-mail: sisn@chemistry.iitd.ac.in*
[b]*Department of Chemistry, Indian Institute of Technology Bombay, Powai, Mumbai 400 076, India. E-mail: rmv@chem.iitb.ac.in*
[c]*Department of Chemistry, University of Alberta, 11227 Saskatchewan Dr, Edmonton, Alberta, Canada. E-mail: erivard@ualberta.ca*

hydrodeoxygenation, Friedel–Crafts dimerization, and carbonyl-olefin metathesis (Greb and co-workers, https://doi.org/10.1039/D4DT03176H), (h) transition metal complexes of triazolyl-based phosphole and azaphosphole ligands and the catalytic activity of the resulting ruthenium complexes in benzylic C–H oxidation (Balakrishna and co-workers, https://doi.org/10.1039/D4DT03213F), (i) use of manganese 2-phosphinophosphinine complexes as pre-catalysts for the Guerbet upgrading of methanol and ethanol to isobutanol (Mansell and co-workers, https://doi.org/10.1039/D4DT02142H), (j) an ONO-donor ligand-supported oxomolybdenum-based metallomicellar catalyst and its role in the aerobic oxidative synthesis of benzimidazoles in water (Chand and co-workers, https://doi.org/10.1039/D4DT03406F), and (k) isolation of allyl functionalized organotellurium macrocycles that catalyze the detoxification of 2-chloroethyl ethyl sulfide (CEES) (Steiner, Baskar and co-workers, https://doi.org/10.1039/D4DT03388D.

The other relevant work presented in the remaining communications and research articles of this collection include: (i) isolation of beryllium-based pseudohalide Grignard reagents (Braunschweig and co-workers, https://doi.org/10.1039/D4DT02457E), (ii) a study of the photophysical, electrochemical, and NLO properties of O,S-chelated bis(pentafluorophenyl)boron and diphenylboron-β-thioketonates (Das, Venkatasubbaiah and co-workers, https://doi.org/10.1039/D4DT02471K), (iii) investigating aminoboranes with phenoxazine/phenothiazine donors and dixylylborane acceptors for delayed luminescence (Munthasir, Thilagar and co-worker, https://doi.org/10.1039/D4DT03200D), (iv) aggregation-induced enhanced emission and mechanoresponsive features of organoboron complexes supported by triaminoguanidine-salicylidene-based Schiff base ligands (Murugesapandian and co-workers, https://doi.org/10.1039/D4DT03217A), (v) synthesis of iron-aluminyl complexes through mechanochemical methods (Hicks and co-workers, https://doi.org/10.1039/D4DT01774A), (vi) dialane synthesis by reducing an alane (Stalke and co-workers, https://doi.org/10.1039/D4DT01798F), (vii) preparation of tri-coordinated monomeric bis(ferrocenyl) haloalumanes (Sasamori and co-workers, https://doi.org/10.1039/D4DT03233K), (viii) use of bidentate and flexible aluminum Lewis acids for the formation of host–guest assemblies (Liu and co-workers, https://doi.org/10.1039/D4DT03288H), (ix) N-heterocyclic carbene (NHC)-stabilized M(I) cations (M = Fe, Co, Ni) (Hadlington and Schulz, https://doi.org/10.1039/D4DT02372B), (x) NHC-assisted C–F bond activation of perfluoronaphthalene (Ghosh, Vanka, Singh, Sen and co-workers, https://doi.org/10.1039/D4DT02791D), (xi) hydrogen-bridged bis(silylene) complex-mediated activation of small molecules (Hashimoto and co-workers, https://doi.org/10.1039/D4DT03226H), (xii) isolation of new siloles bearing distinct functional groups at silicon (Saito and co-workers, https://doi.org/10.1039/D4DT03537B), (xiii) electrochemical measurement of the dipole moments of polyhedral oligomeric silsesquioxanes (Naka and co-workers, https://doi.org/10.1039/D4DT03230F), (xiv) examining the impact of gradually increasing sterics within a hexaanionic cyclophosphazenate ligand on the coordination of ethylzinc arrays (Steiner and co-workers, https://doi.org/10.1039/D4DT03004D), (xv) examining the synthesis and reactivity of phosphazane macrocycles (Singh and co-workers, https://doi.org/10.1039/D4DT03229B), (xvi) development of an easy procedure for preparing multilayer metal phosphonates which improves upon the harsh conditions needed for traditional solvothermal procedures (Murugavel and co-workers, https://doi.org/10.1039/D4DT01668H), (xvii) a report on novel layered chiral indium phosphonates (Zheng and co-workers, https://doi.org/10.1039/D4DT03227F), (xviii) photophysical properties of imidazol-2-thione- and -selone-stabilized Zn(II) halide complexes (Prabusankar and co-workers, https://doi.org/10.1039/D4DT02924K), (xix) ferrocenyl perylene-diimide-based donor–acceptor derivatives that show NIR absorption (Misra and Wazid, https://doi.org/10.1039/D4DT01661K), and (xx) report of doubly N-confused porphyrinoids with tunable aromaticity (Comba, Rath and co-workers, https://doi.org/10.1039/D4DT03265A).

Nearly every cutting-edge research topic in the chemistry of main group element compounds is captured in the collection. As a result, this compilation is believed to function as a single source of information for readers seeking to obtain a collective glimpse of developments in contemporary main group chemistry research.

It is pertinent to note that almost all thirty-three articles included in this collection have been contributed by people who have been either former students, colleagues, or collaborators of Chandra over the last four decades and who wish to dedicate their work to him in recognition of his sustained contributions to several aspects of main group chemistry, that include, synthesis, structural characterization, catalysis, and molecular magnetism. Apart from the excellent work Chandra has contributed to the field of main group chemistry, his book on Inorganic Polymers is a prescribed textbook for many Master's programs worldwide. The guest editors of this collection wish to thank all the authors for providing such an interesting and diverse range of publications. We also wish Chandra many more years of continued contribution to the cause of main group chemistry.