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EDITORIAL

Special issue on 150 years of the periodic table

The UNESCO selected 2019 as the Year of the Periodic Table of Elements, commemorating the 150th year of its discovery. IUPAC, Science Academies, and Universities around the world have been organizing special programs to celebrate this most important organizational tool in Chemistry. Chemical societies around the world continue incessantly with year-long celebrations. These are most appropriate and anticipated, considering the history of the elements and their compounds, the stuff of chemistry. Many poems, musicals, paintings, plays, games, philosophies, models, and theories have come into existence over the years as human beings ponder over elements and their combinations. Civilizations evolved and disappeared pondering over these. There is very little we know which is not a chemical or a chemical transformation; even the process of 'knowing' is the result of chemical transformations.

Many journals have brought out special issues, and virtual issues of collated articles, highlighting different aspects of the Periodic Table of Elements. The Journal of Chemical Sciences published by the Indian Academy of Sciences and Springer decided to have a special issue celebrating the Year of the Periodic Table of Elements and selected three of us as the Guest Editors. It was felt that we could have two kinds of articles. One set dealing with some general aspects of the Periodic Table of Elements, pertaining to several elements or some chemical or physical aspects that spans one or more blocks of the Table, and another set emphasising specific chemistry involving one or more elements. Obviously there is no clear demarcation among these two kinds. With this idea, thirty authors were invited to contribute articles. Ultimately eleven articles went through the editorial process successfully and are published in this issue.

Celebration of the Year of the Lewis two-centre two-electron bond three years ago is still fresh in our memory; Bonding and Periodic Table of Elements are inseparable. So the issue starts with an article by Arunan and Das on the bonding of homonuclear diatomics of the second row of the Table: Li to Ne, with LiF and HF thrown in for good measure. As the authors point out, these simple molecules span the entire spectrum of bonds: ionic, covalent, van der Waals and everything in between, and the complexities involved in determining bond multiplicities which depend on the method of computational analysis.

The history of the Periodic Table of Elements is replete with debates about the placement of elements. While quantum mechanics of atoms assigns the lowest energy electronic configuration for each element, these are not always in tune with the Table as we envisage based on the H-atom solution. There were arguments about keeping H atom above Li or F. One of the continuing discussion is the placement of the first and last elements of the Lanthanides and the Actinides. Chandrasekar, Joshy and Ghanty review their arguments for placing all the fifteen elements of the Lanthanide block together, though it is clear that this discussion will continue. After another one hundred and fifty years, we may have many more elements to place and the debate of placing the elements is bound to be even more complex.

The conversion of waste thermal energy into electrical energy has been an attractive proposition. The efficiency of a thermoelectric material depends, among other things, on the band gap between the valence band and the conduction band. Rathore, Datta and Biswas, in the article titled *Influence of Periodic Table in Designing Solid-State Metal Chalcogenides for Thermoelectric Energy conversion* explore the possibilities of designing better thermoelectrics using the periodic trends.

Weak interactions such as the H-Bond, the halogen-bond, and the chalcogen bond (Z-Bond, X-Z$\cdots$Y, Z= any main group element) are known for most of the main group elements. In contrast, there is no example for an M-Bond (X-M$\cdots$Y) where M is an 18 electron transition metal complex. Jyothish and Jemmis review the reasons for their absence and suggest ways to design ligands that would bring in sigma-holes to make this happen.

Chemists continue the search for Single Molecule Magnets (SMMs). Dey and Rajaraman predict several candidates involving the Actinides for SMMs using *ab intio* electronic structure theory to encourage greater experimental exploration of the Actinides, especially of U and Pu.

Variation of Lewis acidity as one goes down a group in the periodic table has been the theme of

research of Ajay Venugopal, who along with his student Johnson, presents a comparative study of the Lewis Acidities of $SbCl_3$ and $BiCl_3$. The higher acidity of Bi is demonstrated using many ways, including the Gutmann-Beckett method.

Anukul Jana and co-workers report their studies on the synthesis and structures of phosphate diesters, giving special attention to the variation in the solid state structure as a function of the substituents and solvents. The role of weak intermolecular interactions in deciding the details of the structures is of special interest here.

Hydroboration of heteroaromatic compounds to dienes and their further transformation are important in many synthetic strategies. Chidambaram and Chatterjee present an extensive review of the many variations available for this transformation, under s, p, d and f block elements. The advantages of each method are discussed in detail so that the review will help plan efficient synthetic procedures.

C-H bond activation of arenes is a sought after synthetic step. Punniyamurthy and co-workers report a binol assisted C-H bond functionalization catalysed by Ru(II) which is regiospecific. The reaction that leads to the coupling with disulphides or diselenides can be done in the presence of air, with relatively inexpensive Ru making it very appealing in the laboratory.

Bridged binuclear complexes are of interest for several reasons. Sundargopal Ghosh and co-workers describe the synthesis and characterisation of binuclear complexes of Cr, Mo, W, and Nb with bridging ligands such as S_2, Se_2, B_5H_8 and B_2H_6. In addition, metal-metal, multiple bond characteristics of these systems are probed by the electronic structure calculations.

Oxindoles appear in many pharmaceutical drugs and any method for their easy synthesis is welcome. Reddy, Nayak and Ambarasan present an Rh-catalysed Sommelet-Hauser type rearrangement that helps to synthesise oxindole derivatives which can be easily functionalized further. The method provides direct access to thio- and seleno-derivatives.

We thank all the authors who accepted the invitation and sent articles for the special issue, and the reviewers who sent reports promptly. We also thank the Journal of Chemical Sciences for inviting us to edit this special issue on the occasion of the Year of the Periodic Table of Elements.

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