10
Summary and Conclusions

In summary, the thesis involves the synthesis and structural characterization of Sn-O and Sn-S units containing organotin complexes using intramolecular N→Sn coordination. These complexes were further characterized with ^{1}H, ^{13}C, ^{119}Sn NMR, FTIR, UV-vis spectroscopy, elemental analysis, and ESI-MS spectrometry. The application of a few of the complexes in resistive switching devices and antibacterial properties were also examined. The thesis work is summarized in the upcoming sections.

10.1 SUMMARY

Chapter 1 gives an overview of the organotin compounds, structural categorization, and their applications in the electronic and biologically driven research area.

Chapter 2 discuss the characterization techniques and the synthesis of precursors used in this work.

Chapter 3 demonstrates a molecular memory switching device made up of a tetranuclear organotin sulfide cage $[(RSn^{IV})_4(\mu\text{-}S)_6]\cdot 2CHCl_3\cdot 4H_2O$ [R = 2-(Phenylazo)phenyl)] with an ON/OFF ratio of 10^3.

Chapter 4 is focused on the synthesis and DFT-AIM-NBO studies of a novel octanuclear organotin copper sulfide cage $[(RSnCu)_4(\mu_3\text{-}S)_8]\cdot 2CHCl_3$ [R = 2-(phenylazo)phenyl)] designed using N→Sn intramolecular coordination approach.

Chapter 5 discuss the synthesis, structure, DFT-NBO studies, and the antibacterial behavior of a 2-phenylazophenyl substituted diorganotin sulfide $[R_2Sn(\mu\text{-}S)]_2$.

Chapter 6 displayed the successful examination of an NDR (negative differential resistance) device using hydroxo-methoxo bridged dinuclear organostannoxane $[(RSn^{IV})_2(\mu\text{-}OH)(\mu\text{-}OMe)Cl_4]\cdot CH_3OH$.

Chapter 7 presents a discussion on the synthesis, structural characterization, and investigation of antibacterial activity for di-, tetra-, and hexanuclear organostannoxanes.

Chapter 8 is focused on the synthesis and structure of a novel non-football type dodecanuclear organostannoxane $[(RSn)_{12}(\mu_3\text{-}O)_4(\mu_2\text{-}O)_3(\mu_2\text{-}OH)_{21}][Cl]\cdot 5PhCH_3\cdot THF$ and its further application in NDR device with high repeatability of 200 cycles and retention of 1000 s.

Chapter 9 discuss a series of diorganostannoxanes synthesized using the N→Sn intramolecular coordination approach. Furthermore, Hirshfeld surface analyses were examined in order to analyze the intermolecular interactions in the complexes.

10.2 CONCLUDING REMARKS

A variety of organotin compounds having Sn-S and Sn-O units have been reported during the last two decades. In most cases, these compounds are synthesized from a limited number of organotin starting precursor available. However, the presence of large structural diversity shows the complexity that is present amongst the different structures of organotin compounds. In this thesis, various organotin complexes having Sn-S and Sn-O units have been synthesized and structurally characterized using intramolecular coordination strategy. The role of N→Sn intramolecular coordination appears prominent in isolating these complexes. Some of the organotin complexes, in a first of its kind study, have been studied as molecular materials for the resistive switching device. Apart from molecular electronic device studies, some of the complexes were examined for their antibacterial behavior, which in turn displayed a good response against gram-positive and gram-negative bacteria. It is our belief that, in future the

family of organotin clusters will continue to grow, as demonstrated in this thesis by the discovery of novel octanuclear organotin copper sulfide cage and a new Sn_{12} oxo-hydroxo cage member, which will help in further understanding about this class of compounds and accordingly new applications can be explored.

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