Abstract

Molecular materials based on organometallic complexes have witnessed significant attention in the past few years due to their solution processability, flexibility in designing, and ease of device fabrication. Molecular organometallic complexes have been considered the potential candidates to address various challenges in the area of molecular electronics, such as data storage and data handling. Various electronic devices using the molecular system are being explored continuously. On the other hand, the coordination chemistry of molecular organotin complexes is well documented in the literature. Organotin complexes exhibit a wide range of fascinating structures because of the highly expandable coordination site of the tin atom. Organotin complexes, that are studied, are comprised of two major classes; one containing Sn-S unit in their structure known as organotin sulfides, and the other containing Sn-O unit in their structure known as organostannoxanes. Unlike organostannoxanes, the structural chemistry of organotin sulfides is not much explored. Intramolecular coordination appears to be crucial in terms of stabilizing unique structural motifs in organotin complexes. There are limited reports on O→Sn and N→Sn intramolecularly coordinated organotin complexes in the literature. Although organotin complexes are explored for their vast structural diversity, they are not explored as molecular materials. This thesis is focused majorly on the synthesis and structural characterization of new organotin complexes using the intramolecular N→Sn coordination approach and their applications as molecular materials and biological activity. In the quest to search for new molecular materials, we have successfully demonstrated a molecular memory device based on a tetranuclear organotin sulfide cage, negative differential resistance (NDR) device based on a dinuclear hydroxo-methoxo bridged organostannoxane, and a novel dodecanuclear oxo-hydroxo Sn_{12} cage cluster. Apart from the device properties, biological studies were also explored for a dinuclear organotin sulfide and a few organostannoxanes, which showed significant bactericidal activity against both gram-positive (M. luteus) and negative (E. coli) bacteria. The structural features involving the role of intramolecular N→Sn coordination were also examined for various organostannoxanes.

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