RESISTIVE MEMORY DEVICE DESIGNED USING A SOLUTION-PROCESSABLE PHENALENYL-BASED Co(II) COMPLEX: EXPERIMENTAL AND TD-DFT STUDIES

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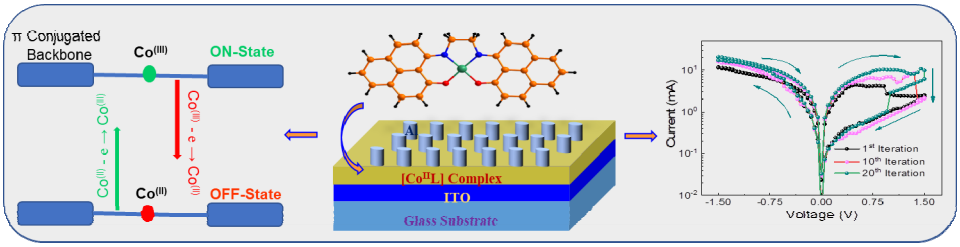
The impressive characteristics of the transition metal complexes (TMCs) with redox-active ligand design are often recognized for their potential to adhere superior redox behavior, and their wide domain of physical applications. The concept of using such redox-active molecular design to construct next generation data storage devices has emerged out to successfully challenge the traditional silicon based storage devices. Various TMCs have been reported till date where data can be stored by switching the resistance on a molecular level, either by the mechanism of charge transfer transitions within the molecule, or by the switching between different two redox-states of the employed molecule. TMCs provide an avenue to researchers to explore a vast pool of molecules, as TMCs are not limited by their structural diversity and they can be easily functionalized using synthetic organic techniques.[1] In the same interest, we have designed a novel square planar Co(II)-phenalenyl complex, [Co^{II}L]; LH_2, *9,9'-(Ethane-1,2-diylbis(azanediyl))bis(1H-phenalen-1-one)* and characterized it with a set of analytical tools such as SCXRD, HRMS, elemental analysis, EPR, etc. The resistive storage device constructed with [Co^{II}L] complex as an active layer has presented a very impressive low voltage (0.3 V) switching which is very rare, and is explained with the help of interesting π-π molecular orbital overlap of the planar molecule in solid state. Further, detailed electrochemical experiments and theoretical studies (TD-DFT) have been performed to understand the redox-switching mechanism taking place at the molecular level. Henceforth, this is an elaborative study explaining the synthesis of the molecular [Co^{II}L] complex, its resistive memory device fabrication, supra-molecular solid state-packing and plausible mechanism for the operation of designed RRAM device.[2]



[1] Hong, E. Y. H.; Poon, C. T.; Yam, V. W. W., *J. Am. Chem. Soc.* **2016**, 138 (20), 6368–6371.

[2] Kamboj, N.; Betal, A.; Majumder, M.; Sahu, S.; Metre, R. K., *Inorg. Chem*. **2023**, 62, 10, 4170–4180.