

Organic Radical Ions and their Multifaceted Properties: From Panchromism and Sensing to Ambient Stabilization

Pritam Mukhopadhyay

School of Physical Sciences, Jawaharlal Nehru University, New Delhi 110067

Email: m_pritam@mail.jnu.ac.in or pritam.jnu@gmail.com

π -conjugated molecules are intriguing building blocks to realize diverse range of closed and open-shell molecular materials.¹ In this context, the naphthalenediimide (NDI) and the perylenediimide (PDI) π -scaffold provides an intriguing platform to design new opto-electro-active molecules.²

This talk would provide an insight into how organic radical ions having NDI/PDI scaffolds can perform the role of sensing and logic operations utilizing their multi-channel absorption bands. These radical anions with persistent lifetime offers attractive NIR absorption and panchromism.³ In this talk, we would also discuss about our recent findings, which allowed us to stabilize these colorful radical ions under ambient conditions^{4a,b} as well as isolate the strongest electron acceptors with calculated LUMO of -5.2 eV (**Figure**).⁵ Furthermore, we have expanded the synthesis of radical ions utilizing eco-friendly, sustainable green methods.⁶ Recently, we could also isolate doubly zwitterionic, highly electron-rich direduced NDI systems with tunable optical properties.⁷ Their excited states would be of interest for photo catalysis and other opto-electronic applications.

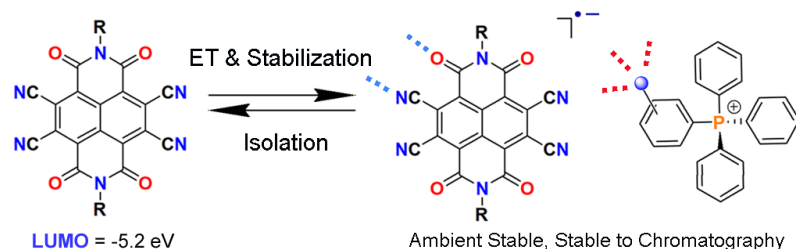


Figure: Synthesis and isolation of planar radical anion and its highly electron-deficient precursor.

References

1. Morita, Y.; Suzuki, S.; Sato, K.; Takui, T. *Nature Chem.* **2011**, *3*, 197.
2. Kumar, S.; Shukla, J.; Kumar, Y.; Mukhopadhyay, P. *Org. Chem. Front.*, **2018**, *5*, 2254.
3. a) Ajayakumar, M. R., S. Yadav, S. Ghosh and P. Mukhopadhyay, *Org. Lett.* **2010**, *12*, 2646; b) Ajayakumar, M. R., D. Asthana and P. Mukhopadhyay, *Org. Lett.* **2012**, *14*, 4822.; c) Ajayakumar, M. R., G. Hundal, P. Mukhopadhyay, *Chem. Commun.* **2013**, *49*, 7684.
4. a) Kumar, S.; Ajayakumar, M. R.; Hundal, G.; Mukhopadhyay, P. *J. Am. Chem. Soc.* **2014**, *136*, 12004; b) Kumar, Y.; Kumar, S.; Bansal, D.; Mukhopadhyay, P. *Org. Lett.* **2019**, *21*, 2185.
5. Kumar, Y.; Kumar, S.; Mandal, K.; Mukhopadhyay, P. *Angew. Chem. Int. Ed.* **2018**, *57*, 16318;
6. Kumar, S.; Mukhopadhyay, P. *Green. Chem.* **2018**, *20*, 4620.
7. Kumar, S.; Shukla, J.; Kumar, Y.; Mandal, K.; Prakash, R.; Ram, P.; Mukhopadhyay, P. *Chem. Sci.* **2019**, *10*, 6482.