**Nitroxide Radical Materials for Organic Energy Storage**

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**Introduction**

Nitroxide radicals have been attracting enormous attentions over decades due to their broad applications across chemistry and biology (Zhang 2016). In particular, the past decade has seen a resurgence of nitroxide radicals primarily due to some breakthrough applications in catalysis and energy storage. Incorporating nitroxide radicals onto the polymer backbone imparts the materials with excellent electrochemical properties from nitroxide radicals as well as flexibility and processability from polymer backbone (Muench 2016). The electrochemical properties of such a type of electrode are strongly affected by its chemical structure and its polymer chain structure, as well as the microstructure of electrode composites.

**Discussion**

We have systematically studied the impact of the different functional substitutions and/or heteroatom insertions on their electrochemical oxidation behaviour of cyclic nitroxide radicals both experimentally and computationally (Zhang 2018). We also looked at the molecular weight effect on the electrochemical performance of nitroxide radical polymers (Zhang 2017). In particular, we introduced a non-covalent interaction to form the nitroxide radical polymer electrode that can significantly enhance their battery performance in both lithium-ion battery and sodium-ion battery (Zhang 2017; Hu 2018). Very recently, we have developed a nitroxide radical polymer with conjugated backbone by living cyclopolymerization method. This polymer can be directly coated on the carbon clothes as cathode for battery or supercapacitors (Xie 2019).

**Conclusion**

Our work highlights the importance of structure-(electro)chemical property relationship of nitroxide radical and their applications and provides guidance on rational design of organic radical electrode and catalyst with optimal properties.

**References**

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