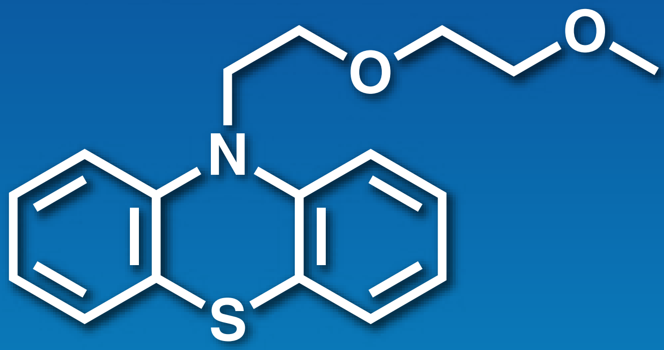
New

Non-Aqueous Redox Flow Battery Material MEEPT

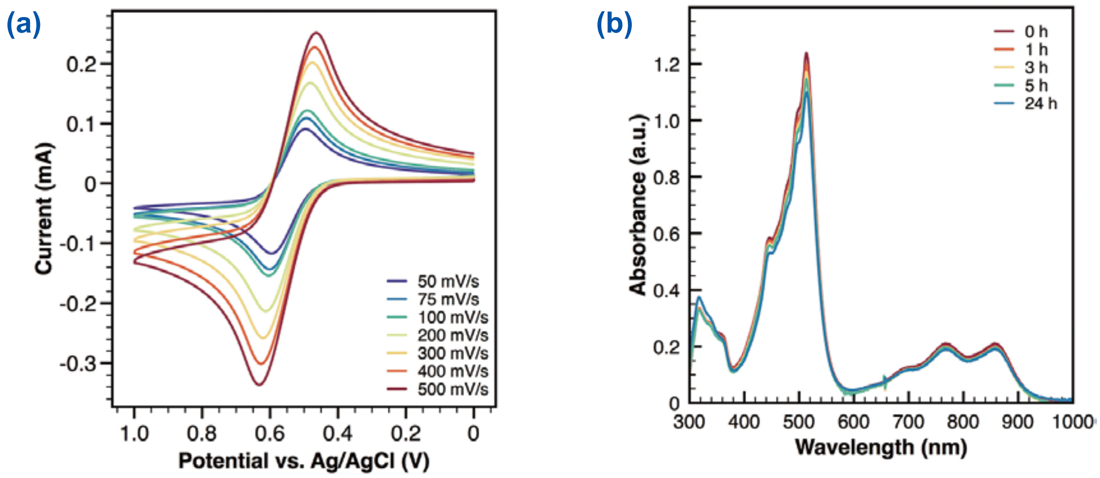


[M3068]

Advantages

- Catholyte for non-aqueous redox flow battery (RFB)
- High current density
- Long duration cycling
- Miscible with non-aqueous organic solvents and electrolytes
- Oxidation potentials: 0.31 V (vs Fc/Fc^{+}) in $TEA\text{-}BF_4$ MeCN solution; 3.60 V (vs. Li/Li^{+}) in $LiPF_6$-EC/EMC

Electrochemical and Spectral Properties of MEEPT/$MEEPT^{+}$



(a) Cyclic voltammogram of MEEPT at 10 mM in 0.1 M $TBAPF_6$ in DCM recorded at scan rates from 10 to 500 mV/s
(b) UV-vis spectra of MEEPT-$SbCl_6$ at 0.15 mM in acetonitrile for up to 24 h after dissolution

These graphical materials were provided by Prof. Odom.

J. D. Milshtein, A. P. Kaur, M. D. Casselman, J. A. Kowalski, S. Modekrutti, P. L. Zhang, N. H. Attanayake, C. F. Elliott, S. R. Parkin, C. Risko, F. R. Brushett, S. A. Odom, *Energy Environ. Sci.* **2016**, *9*, 3531.

M3068 10-[2-(2-Methoxyethoxy)ethyl]-10*H*-phenothiazine (= MEEPT) 10g

This material was produced by collaboration with Prof. Susan Odom at University of Kentucky.

Introduction of the Researcher

The Odom Research Group – University of Kentucky

Professor Susan A. Odom

Research in the Odom group focuses on the design and synthesis of stable electro-active organic compounds for use in applications requiring reversible electron-transfer reactions, which is enabled through increased stability of their oxidized or reduced forms.

Stable electro-active organic compounds have been utilized in a variety of applications in organic electronics, photovoltaics, and catalysis. An area of particular interest is identifying materials with characteristics amenable for use in non-aqueous redox flow batteries (RFBs). Materials for this application must be highly soluble and highly stable in a battery environment and - for practical use – must be scalable and low cost. We have focused the functionalization of heterocyclic fused-ring compounds such as building blocks and have developed stable materials with extensive performance at high concentration cycling experiments in non-aqueous environments.

Learn more about the Odom Research Group
Website: http://www.chem.uky.edu/research/odom/index.html
Recent publications: https://chem.as.uky.edu/users/saodom0

Developing Stable Electron Donors

The Odom research group focuses on the design, synthesis, and characterization of electroactive materials in various states of oxidation or reduction, with a main goal of identifying characteristics in molecular structure that lead to more robust materials. We generate radical cations and anions through redox reactions with chemical reagents and through bulk electrolysis, then analyze the stability using UV-vis and EPR spectroscopy, and utilize NMR and mass spectrometry to determine decomposition products.[1),2),3)] Through this combination of techniques, we have designed more stable materials. In some cases, the radical cation salts of phenothiazine derivatives have been sufficiently stable to allow for isolation of X-ray quality single crystals.

Relevant Publications

1) A Fast, Inexpensive Method for Predicting Overcharge Performance in Lithium-Ion Batteries
S.A. Odom, S. Ergun, P.P. Poudel, S.R. Parkin, *Energy Environ. Sci.* **2014**, *7*, 760.

2) *N*-Substituted Phenothiazine Derivatives: How Stability of the Neutral and Radical Cation Forms Affects Overcharge Performance in Lithium-Ion Batteries (cover article)
K.A. Narayana, M.D. Casselman, C.F. Elliott, S. Ergun, C. Risko, S.A. Odom, *ChemPhysChem* **2015**, *16*, 1179.

3) The Fate of Phenothiazine-Based Redox Shuttles in Lithium-Ion Batteries
M.D. Casselman, A.P. Kaur, K.A. Narayana, C.F. Elliott, C. Risko, S.A. Odom, *Phys. Chem. Chem. Phys.* **2015**, *17*, 6905.

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