4-1-2019

Molybdenum Oxides for Energy Generation and Storage Using Efficient Clean Method

Camila Zequine
Pittsburg State University

Pawan K. Kahol
Pittsburg State University

Ram K. Gupta
Pittsburg State University

Molybdenum Oxides for Energy Generation and Storage Using Efficient Clean Method

Camila Zequine, Pawan K. Kahol, Ram K. Gupta
Pittsburg State University, Pittsburg, KS, United States

Introduction

- Owing the crisis energy and the potential degradation of the environment, it is extremely important to develop new materials capable of generating green energy and storing this energy with high efficiency and low cost.
- Water electrolysis is the promising pathway for sustainable oxygen production.
- Transition metal oxides are very attractive for these applications due to their low-cost and rich electrochemical properties.

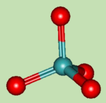
$$2\,H_2O \rightarrow 2\,H_2 + O_2$$

Challenges

- The most efficient electrocatalysts for water splitting are RuO_2 and IrO_2 for oxygen evolution reaction (OER). However, their high cost and lack of abundance, limit their applications as catalysts.
- An ideal electrocatalyst should provide high current density at a lower overpotential.

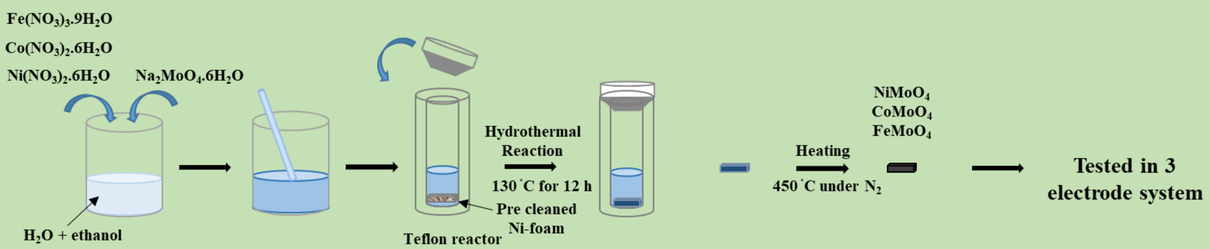
Solution through our research

- Development of materials for OER with excellent electrochemical properties, economically viable and earth abundant.
- Development of energy storage devices (Supercapacitor).

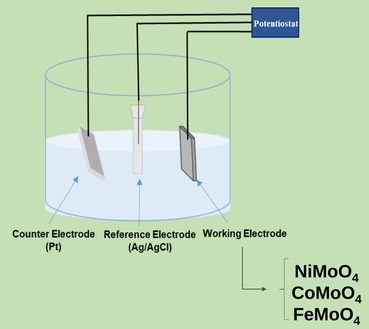


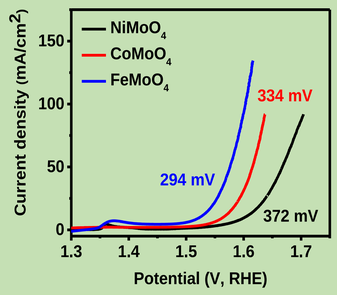
- Research efforts focused in the synthesis of nickel, cobalt and iron molybdates as electrocatalysts.

Experimental



Results and discussion

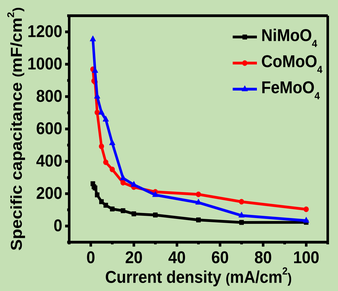




$FeMoO_4$

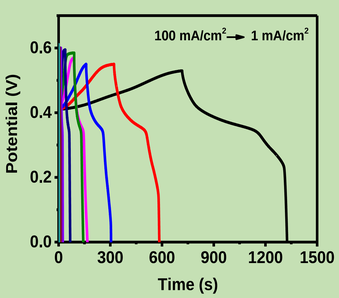
Lowest overpotential

Better energy generation

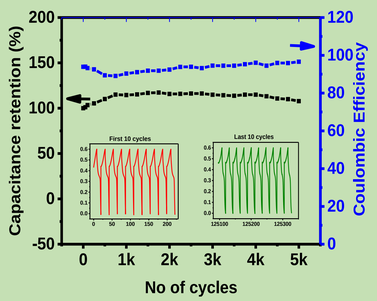


$FeMoO_4$

Highest capacitance → **Better energy storage**



Long charge-discharge process



Excellent capacitance retention and coulombic efficiency over 5,000 cycles

Conclusion and Future Work

- ✓ Molybdenum-based metal oxides could be promising materials for the advancement of energy generation and storage devices.
- ✓ $FeMoO_4$ can produce oxygen efficiently and it shows excellent performance as supercapacitor.

Future work: Study the effect of morphology on the electrochemical properties of the electrocatalysts.

Acknowledgement

Sincere acknowledgment to the Polymer Chemistry Program and Kansas Polymer Research Center for providing research facilities.