DATE
Monday, October 15, 2018

TIME
10:30 AM

LOCATION
Research 1 Bldg. room 101
4353 Scorpius Street
Orlando, FL 32816-0120
University of Central Florida

DEPARTMENT OF PHYSICS

Invited Speaker

UNIVERSITY OF CENTRAL FLORIDA | ORLANDO

UCF

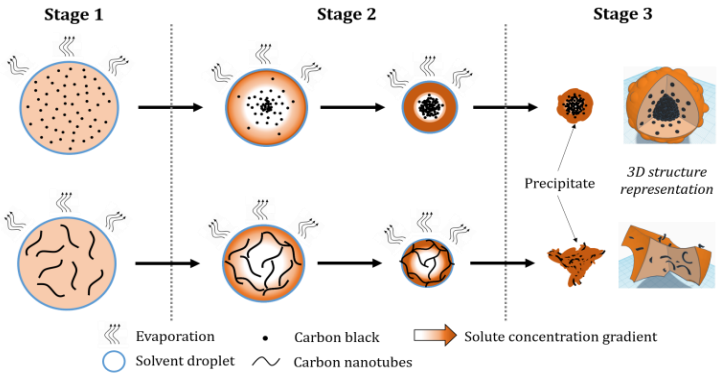
Development of the iron- and vanadium-based electrode materials for rechargeable Li/Na-ion batteries

Presented by Abdelfattah Mahmoud

Lithium-ion batteries have been widely applied as a power source for portable and stationary energy storage systems. Na-ion batteries are considered to be an alternative to Li-ion batteries owing to the natural abundance of sodium. New electrode materials are required to increase the energy density of Li/Na-ion batteries. In this study, we report on the one-step synthesis of composite materials using spray-drying or hydrothermal synthesis routes, two techniques which offer easy scaling-up of production.

The objective of this presentation is to show that the addition of the carbon sources during the synthesis leads to control the particles size and ensures intimate contact between the active material and conductive carbon that enhance the electrochemical performance [1-6].

In order to study the effect of the carbon on the structural, morphological and electrochemical properties of the prepared materials by a spray-drying [1-3] or hydrothermal methods [4-6]. The crystal and local structure were analyzed by XRD and ^{57}Fe Mössbauer spectroscopy. The morphological properties were characterized by SEM and TEM.



Schematic representation of Na_2FePO_4-CB and Na_2FePO_4-CNT growth process during spray-drying synthesis [1].

The carbon content was determined by TG/TDA and carbon analyzer. The electrochemical properties were studied by impedance spectroscopy and galvanostatic cycling in lithium cells. The mechanism of the first discharge-charge cycle was investigated by combining *operando* X-ray diffraction and ^{57}Fe Mössbauer spectroscopy.

References

1- A. Mahmoud, S. Caes, M. Brisbois, R.P. Hermann, L. Berardo, A. Schrijnemakers, C. Malherbe, G. Eppe, R. Cloots, B. Vertruyen, F. Boschini, J. Solid State Electrochemistry (2017) 1–10.
2- N. Eshraghi, S. Caes, A. Mahmoud, R. Cloots, B. Vertruyen, F. Boschini, Electrochimica Acta, 228 (2017) 319–324.
3- B. Vertruyen, N.Eshraghi, C. Piffet, J. Bodart, A. Mahmoud, F. Boschini. Materials 11 (2018) 1076.
4- C. Karegeya, A. Mahmoud, R. Cloots, B. Vertruyen, F. Boschini, , Electrochimica Acta 250 (2017) 49–58.
5- C. Karegeya, A. Mahmoud, F. Hatert, B. Vertruyen, R. Cloots, P-E. Lippens, F. Boschini. J. Power Sources. 388 (2018) 57-64.
6- A. Mahmoud, C. Karegeya, M. T. Sougrati, J. Bodart, B. Vertruyen, R. Cloots, P-E. Lippens, F. Boschini. ACS Applied Materials and interfaces, (2018) 10.1021/acsami.8b10663.

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Abdelfattah Mahmoud, Ph.D., has more than 9 years of experience in research on Energy Storage materials. Since December 2015, Abdelfattah is working at the GreenMat lab of Liège University (Belgium) as a post-doctoral researcher involved in the development of the electrode materials for Alkali-ion batteries and in charge of the analytical platforms of electrochemistry and Mössbauer Spectroscopy. His research project aims at recycling silicon extracted from solar panels as anode materials for Li-ion batteries. Before joining University of Liège, Abdelfattah was Postdoctoral researcher during 2 years at Forschungszentrum Jülich, JCNS-2 (Germany).

His research focused on the characterization of electrochemically active materials by nuclear resonance and neutron scattering techniques. Abdelfattah was awarded a PhD in Materials Science in December 2012, from Cadi Ayyad University in Marrakech (Morocco). During his PhD, he was Guest Researcher at Montpellier University (France) and the Institute of Material Science of Madrid (Spain). His PhD focused on the development of three electrode materials ($MnSn_2$, $LiCo_{2/3}Ni_{1/6}Mn_{1/6}O_2$, $Li_4Ti_5O_{12}$) for high energy density lithium-ion batteries. Abdelfattah authored and co-authored 40 peer-reviewed papers, more than 42 conference papers, invited talks and extended abstracts.