Vinodkumar Etacheri et al., Madridge J Nanotechnol Nanosci. 2018
http://dx.doi.org/10.18689/2638-2075.a3.002

3rd International
Nanotechnology Conference & Expo
May 7-9, 2018 Rome, Italy

Pseudocapacitance Assisted Li and Na Ion Storage in Transition Metal Oxide Nanostructures

Vinodkumar Etacheri[1]*, Rudi Maca[1], Daniel Cintora[1] and **Ivan Jimenez[2]**
[1]IMDEA Materials Institute, Spain
[2]Universidad Rey Juan Carlos, Spain

Development of safer and environmental friendly high energy density rechargeable batteries capable of fast charging and long-term cycling stability is one of the key challenges for modern electrochemistry. During the last two decades, Li-ion battery technology attracted extensive attention due to their widespread application in portable electronics, medical implants, grid-level energy storage and electric vehicles. Recently, secondary Na-ion batteries emerged as a promising candidate for large scale energy storage. This technology attracted immense interest due to low-cost and abundance of resources compared to limited lithium supply. Despite of the several advantages of Li and Na-ion batteries, their energy and power densities are not sufficient for more energy demanding commercial applications such as long-range driving. Pseudocapacitive charge storage is lately demonstrated as a method to improve the power-density of transition metal carbides (MXenes). However this method is difficult to achieve in case of transition metal oxide electrodes due to their low ionic and electronic conductivity. Tailored designing of these electrode materials are therefore required to induce pseudocapacitive Li and Na ion storage.

We have demonstrated pseudocapacitive assisted Li and Na ion storage in ultrathin Co_3O_4 nanosheets, hierarchical Co_3O_4 nanorods, biphasic TiO_2 nanosheets and CoO-RGO hybrid electrodes. In the case of Co_3O_4 based anodes, a maximum Li and Na ion storage capacity of 1400 and 700 mAh/g respectively was obtained (300 mAh/g for biphasic TiO_2 nanosheets). Excellent specific capacity (higher than theoretical limit), rate performance and cycling stability are attributed to pseudocapacitive contribution resulting from tailored interfaces, defects and crystal facets.

Biography:

Dr. Vinodkumar Etacheri is a scientist and electrochemistry group leader at IMDEA Materials Institute, Spain. Dr. Etacheri obtained his PhD in Materials Chemistry from Dublin Institute of Technology (DIT), Ireland in 2011. He then completed postdoctoral research at Bar Ilan University- Israel, University of Michigan- USA and Purdue University USA in the area of Li-ion, Li-O_2, Li-S, and Na-ion batteries. His research areas extend from solar energy conversion to electrochemical energy storage materials and devices. He co-authored more than 25 papers (> 3700 citations) in international peer reviewed journals, 3 book chapters, and 8 patents.