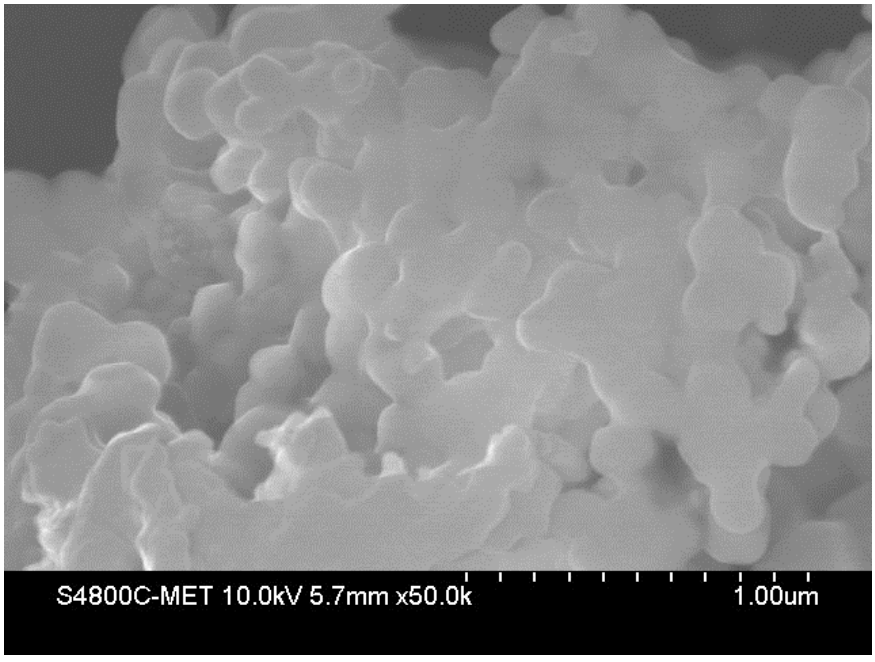
One-pot Al-doped $LiMn_2O_4$ nanosheets as cathode for lithium ion batteries

Akhoon, S. A.[1*], Sofi, A.H.[2], Rubab, S.[2], & Shah, M. A[2]

[1]Department of Applied Sciences, Institute of Technology, University of Kashmir, India.
[2]Department of Physics, National Institute of Technology, Srinagar, India.
*Email Id: akhoon.shabir@yahoo.com

Abstract: Renewable energy resources have been investigated as alternatives to fossil fuels. Though the energy density of these sources are not comparable to the fossil fuels but their abundance make them highly interesting. For example, it is envisaged that the solar energy received by the earth in a single day is sufficient enough to fulfill the energy demands of current world's population for nearly sixteen years [1]. Even though the renewable energy harvesting is very interesting but it is not efficient at the same time. The renewable energy utilization may be divided into three main steps: harvesting, conversion and storage.

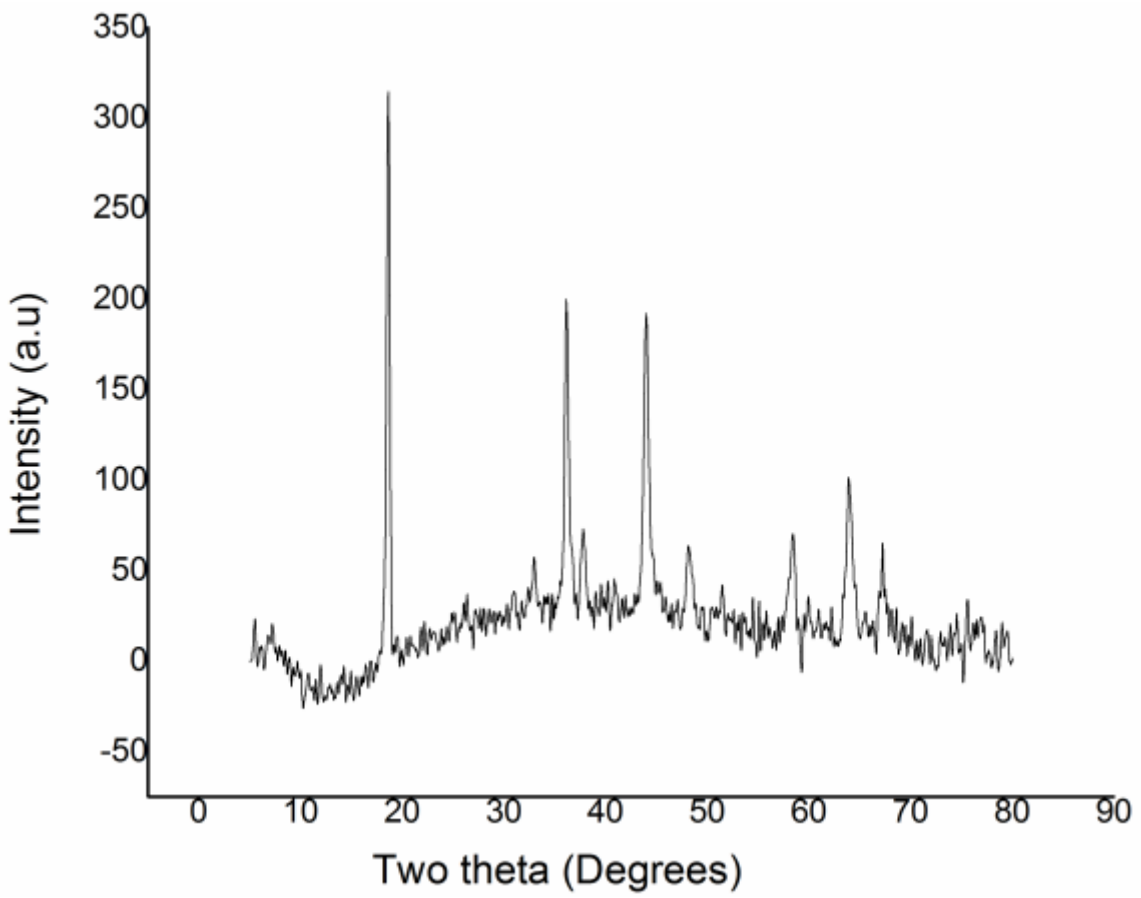
Nanomaterials based novel designs have demonstrated very promising results in increasing the efficiency in energy utilization [2] and as such, electrical energy storage is a key technology. During the last twenty years, great progress has been made in the electrical storage systems, but no current system is able to meet the targets set for the demanding applications, with regards to energy and power density, price and life time [3]. Lithium ion batteries (LIBs) are among the most promising storage devices, offering high energy and power densities, long cycle life, no memory effects and slow self-discharging, finding applications in portable power tools, wireless communication devices and hybrid electric vehicles etc [4]. Lithium ion batteries also do possess advantages of safety, low cost and environmental friendliness [5,6].



5th International Conference on Nanotechnology for Better Living (NBL-2019), Jointly organized by National Institute of Technology (NIT) Srinagar and Indian Institute of Technology (IIT) Kharagpur; April 7 – 11, 2019 at SKUAST, Shalimar Srinagar, Jammu and Kashmir, India; Editor: Dr. M. A. Shah and Prof. P. Banerji, ISBN:978-81-939516-0-6; Published by Applied Science Innovations Pvt. Ltd., Pune, Maharashtra, India.

Among various cathodes proposed for LIBs, the most promising one is the spinel lithium manganese oxide ($LiMn_2O_4$). It makes its way due to its non-toxicity, low cost, abundance and ease of synthesis, besides being environmental friendly [4].

The usual method to produce $LiMn_2O_4$ has been the solid state reaction process. We report the synthesis of spinel phase Aluminum doped lithium manganese oxide ($LiMn_2O_4$) nanosheets through a template-free, one-pot, starch-glycine assisted solution combustion synthesis (SCS). The method is a single step solution combustion method. The resultant powder was characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FE-SEM), Cyclic Voltammetry and Galvanostatic Charge-discharge techniques, which were studied in details to observe the structural and electrochemical properties of the as synthesized Al doped $Limn_2O_4$ nanosheets.



References:

[1] S. A. Akhoon, S. Rubab, M. A. Shah Nanotechnology application for improvements in energy efficiency and environmental management, IGI Global, Pennsylvania, (2014), pp. 277-312.
[2] Y-G Guo, Y-S. Hu, W. Sigle, J. Maier, Adv. Mater. 19 (2007) 2087-2091.
[3] L. Jun, G. Cao, Z. Yang, D. Wang, et. al. Chem. Sus. Chem. 1 (2008) 676-697.
[4] Y. B. R. D Rajesh, R. S. Dubey, Nanosci. Nanoeng. 1 (2013) 139-141.
[5] G. Donglei, Electrochem. 17 (2013) 2849-2856.
[6] G. X. Wang, J. Power Sources 74 (1998) 198-201.

5th International Conference on Nanotechnology for Better Living (NBL-2019), Jointly organized by National Institute of Technology (NIT) Srinagar and Indian Institute of Technology (IIT) Kharagpur; April 7 – 11, 2019 at SKUAST, Shalimar Srinagar, Jammu and Kashmir, India; Editor: Dr. M. A. Shah and Prof. P. Banerji, ISBN:978-81-939516-0-6; Published by Applied Science Innovations Pvt. Ltd., Pune, Maharashtra, India.