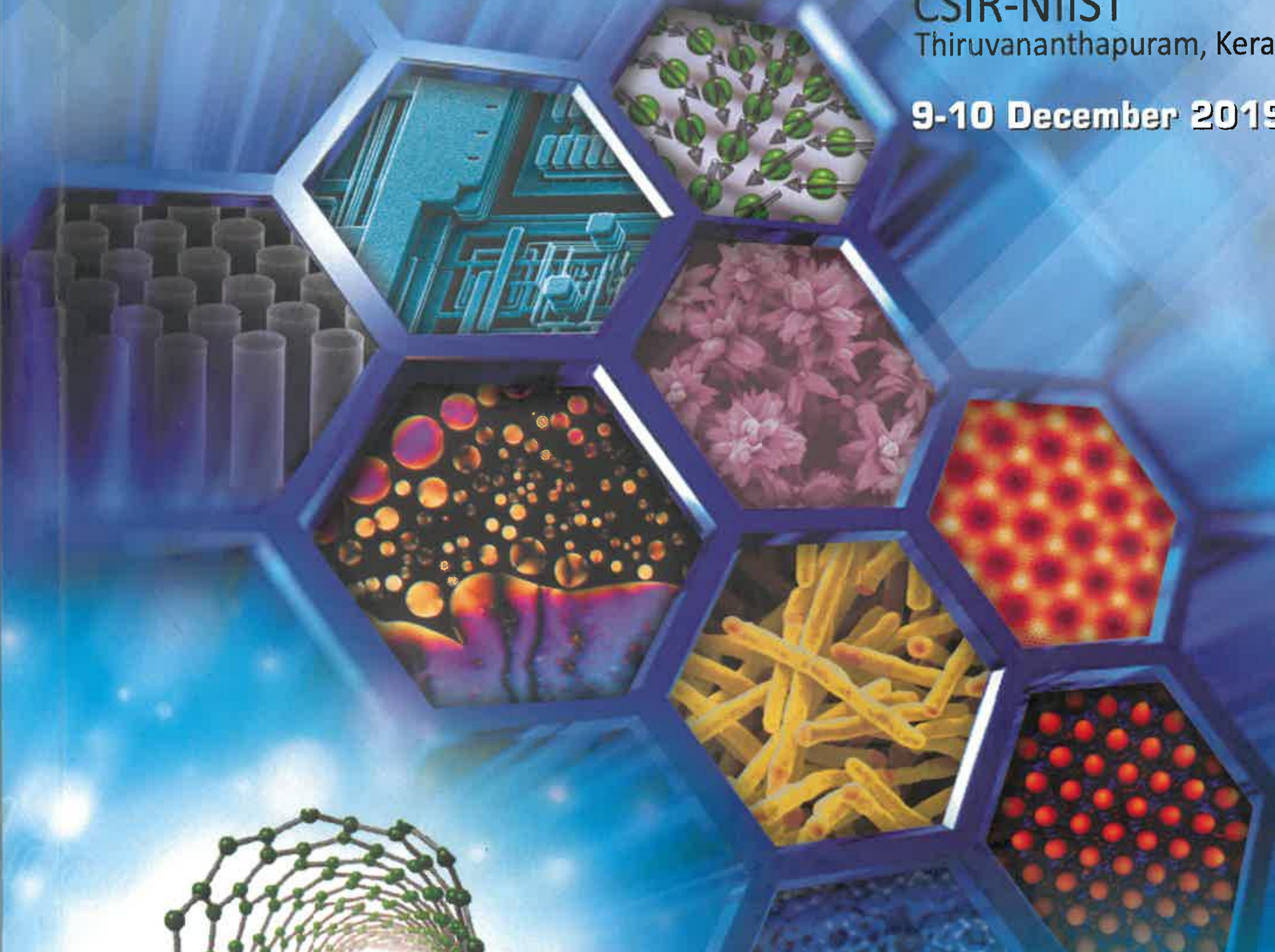
SOUVENIR

THIRD INTERNATIONAL CONFERENCE ON ADVANCED FUNCTIONAL MATERIALS

CSIR-NIIST
Thiruvananthapuram, Kerala

9-10 December 2019



Organised by

CSIR-NIIST, Thiruvananthapuram
ICS Kerala Chapter, Thiruvananthapuram
MRSI, Thiruvananthapuram Chapter

ICAFM 2019

IL-5

Thin metal oxide films on porous carbon for high density charge storage

Bincy Lathakumary Vijayan[1], Izan Izwan Misnon[1],
Gopinathan M. Anil Kumar,[2] Keita Miyajima,[2]
Rajan Jose[1*]

[1]*Nanostructured Renewable Energy Materials Laboratory, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Kuantan, Malaysia*
[2] *R&D Center, Noritake Co Ltd, 300 Higashiyama, Miyoshi, Aichi 470-0293, Japan*

E-Mail: rjose@ump.edu.my

An increase in population, depletion of natural resources, and alarming environmental conditions call for finding primary materials from sustainable and renewable sources; towards this end carbon from bio resources plays a dominant role. Recently, AC from biomass are getting more attention in charge storage applications, typically as a supercapacitor (SC) electrode, owing to their high specific surface area (SSA), surface microstructures, and electrical conductivity. In an effort to minimize the usage of non-renewable materials and to enhance the functionality of the renewable materials, we have developed thin metal oxide coated porous carbon derived from a highly abundant non-edible bio resource, i.e., palm kernel shell [1-2], using a one-step activation-coating procedure and demonstrated their superiority as a supercapacitive energy storage electrode. In a typical experiment, an optimized composition contained ~10 wt.% of Mn_2O_3 on activated carbon (AC); a supercapacitor electrode fabricated using this electrode showed higher rate capability and more than twice specific capacitance than pure carbon electrode and could be cycled over 5000 cycles without any appreciable capacity loss in 1 M Na_2SO_4 electrolyte. A symmetric supercapacitor prototype developed using the optimum electrode showed nearly four times higher energy density than the pure carbon owing to the enhancements in voltage window and capacitance. A lithium ion capacitor fabricated in half-cell configuration using 1 M $LiPF_6$ electrolyte showed larger voltage window, superior capacitance and rate capability in the ~10 wt.% Mn_2O_3@AC than the pure analogue [Figure 1]. These results demonstrate that the current protocol allows fabrication of superior charge storing electrodes using renewable materials functionalized by minimum quantity of earthborn materials [3].

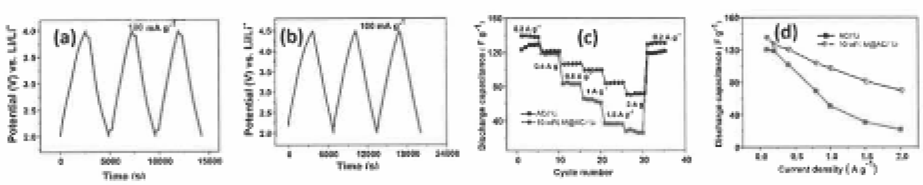


Fig. 1. (a) First three CDC curves of AC// Li; (b) first three CDC curves of 10 wt% M @AC // Li; (c) rate performance with various current densities and (d) comparison of variation of C_s with current densities of AC// Li and 10 wt% M @AC // Li.

References

[1] I.I. Misnon, N.K.M. Zain, R.A. Aziz, B. Vidyadharan, R. Jose, Electrochimica Acta 2015,174, 78-86.
[2] I.I. Misnon, N.K.M. Zain, R. Jose, Waste and Biomass Valorization 2019, 10, 1731-1740.
[3] B. L. Vijayan, I. I. Misnon, G. M. Anil Kumar et al, Journal of Colloids and Interface Science 2019 https://doi.org/10.1016/j.jcis.2019.11.077.