Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Electronic Supplementary Information

MWCNTs-mesoporous silica nanocomposites inserted in polyhedra metal-organic framework as an advanced hybrid material for energy storage device

Zahra Andikaey[a], Ali A. Ensafi*[a], Behzad Rezaei[a], Shaghayegh Sadeghi Malek[a] and Jin-Song Hu[b]

a. Department of Chemistry, Isfahan University of Technology, Isfahan 84156-83111, Iran.

b. Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, P.R. China

Published in New J. Chem.

Table S1. BET surface area and BHJ pore size distribution of the samples.

Sample	$a_{s,BET}$ (m^2 g^{-1})	pore size distribution (nm)
fCNT	140.84	2.8
10% SBA/CNT	242.45	3.2
20% SBA/CNT	296.20	3.5
30% SBA/CNT	498.31	4.0
SC@NCC-BTC	151.50	2.4

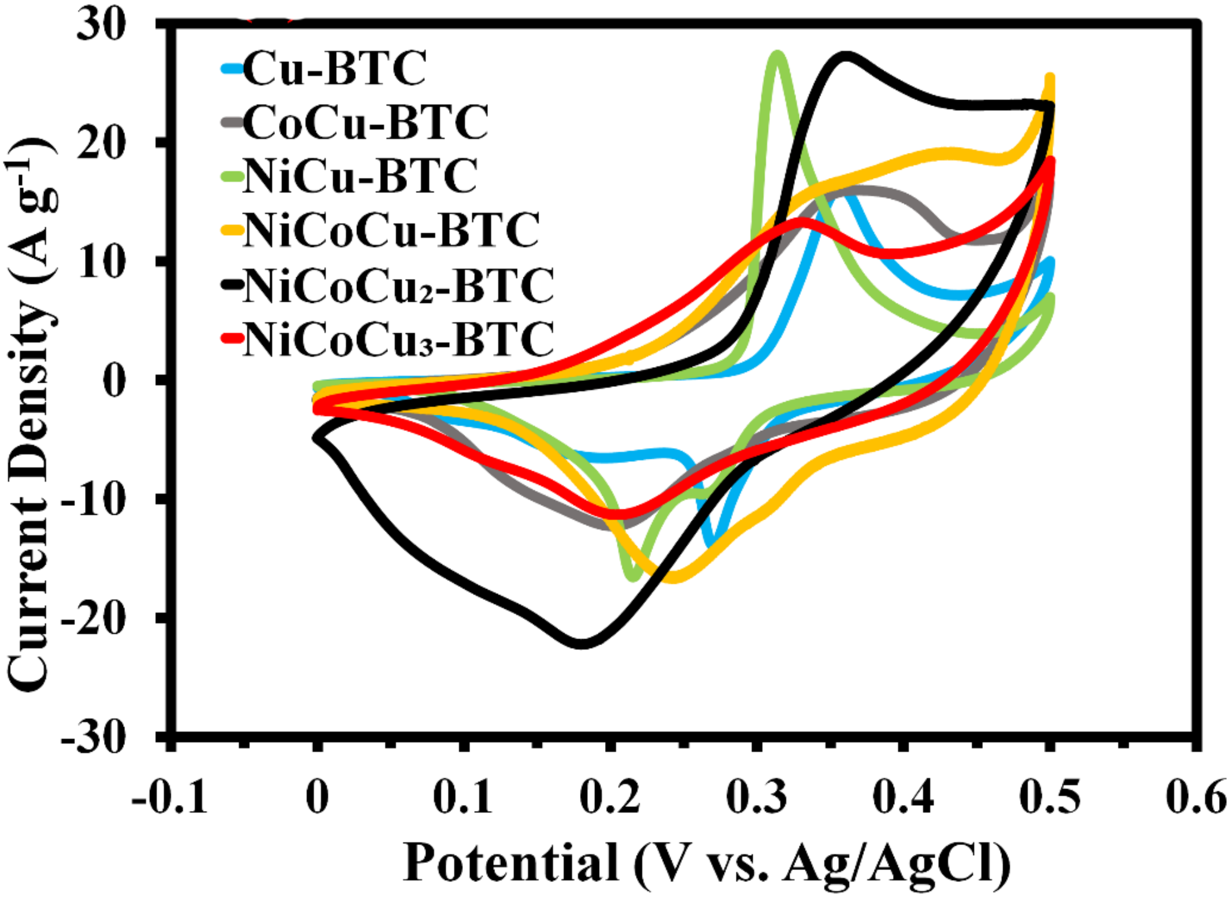

Figure S1 (a) CV curves of Cu-BTC, CoCu-BTC, NiCu-BTC, NiCoCu-BTC, $NiCoCu_2$-BTC, $NiCoCu_3$-BTC at 20 mV s^{-1};

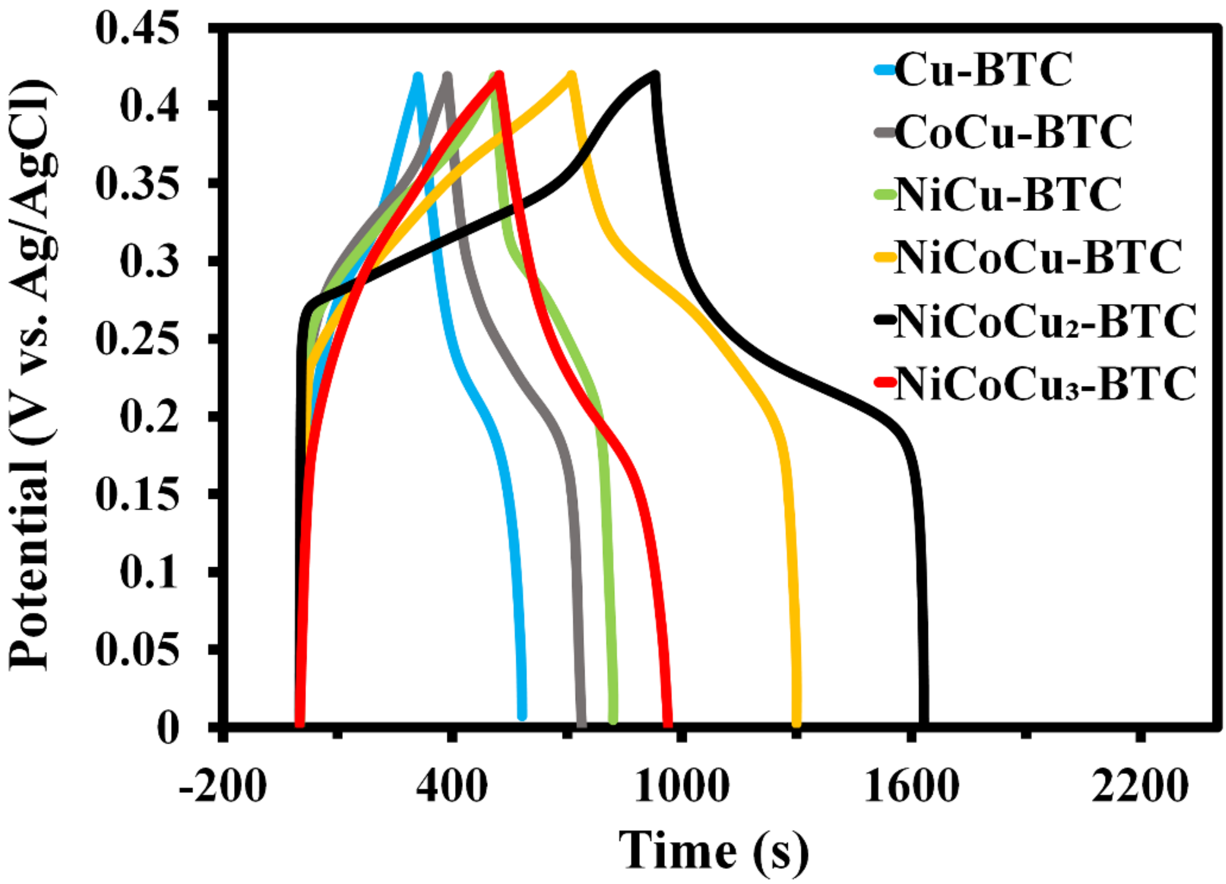

Figure S2 GCD curves of Cu-BTC, CoCu-BTC, NiCu-BTC, NiCoCu-BTC, $NiCoCu_2$-BTC, $NiCoCu_3$-BTC at 1.0 A g^{-1};

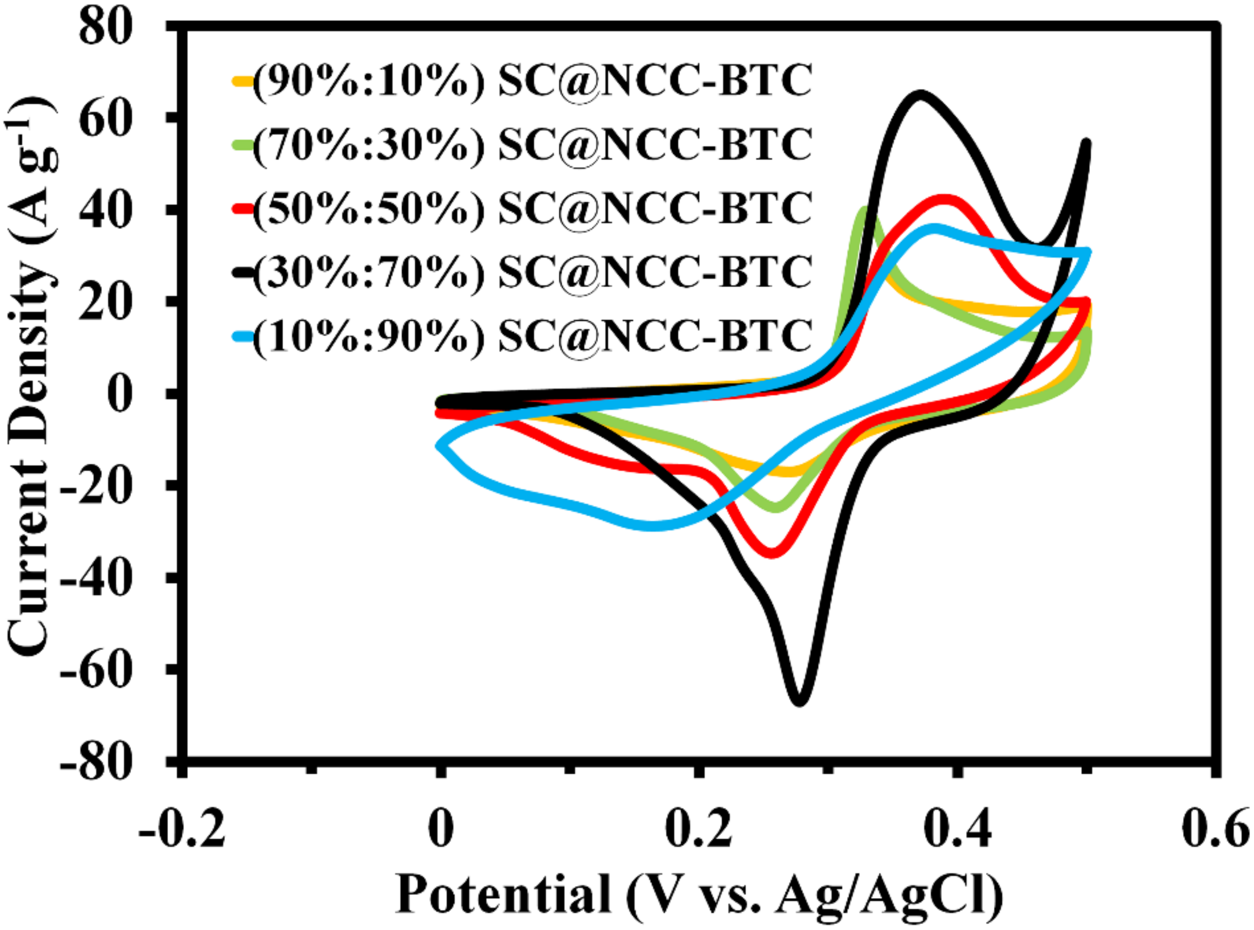

Figure S3 Optimization of the SC percentage in SC@NCC-BTC composite, CVs of SC@NCC-BTC electrode in deferent SC@NCC-BTC ratios of 90:10, 70:30, 50:50, 30:70, and 10:90, respectively; The CVs were recorded at a sweep rate of 20 mV s^{-1} in 3.0 mol L^{-1}

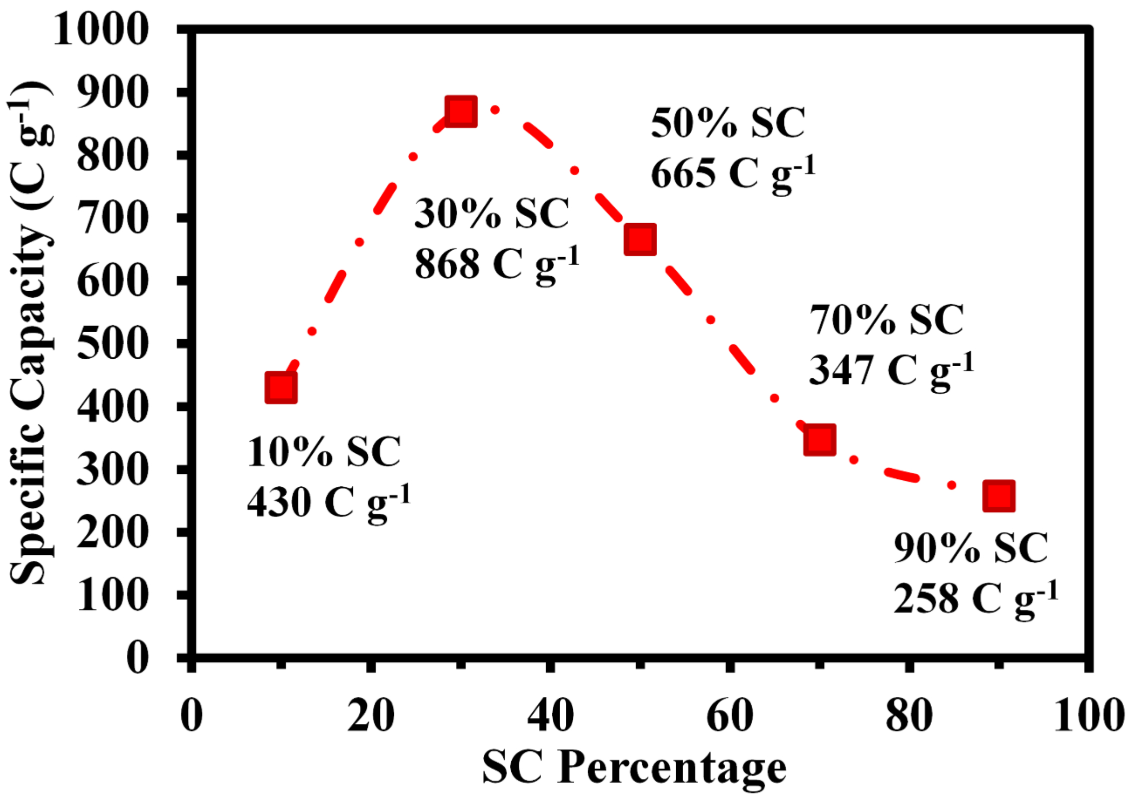

Figure S4 A plot of the specific capacity of SC@NCC-BTC electrode as a criterion of optimization *vs.* the SC percentage**.**

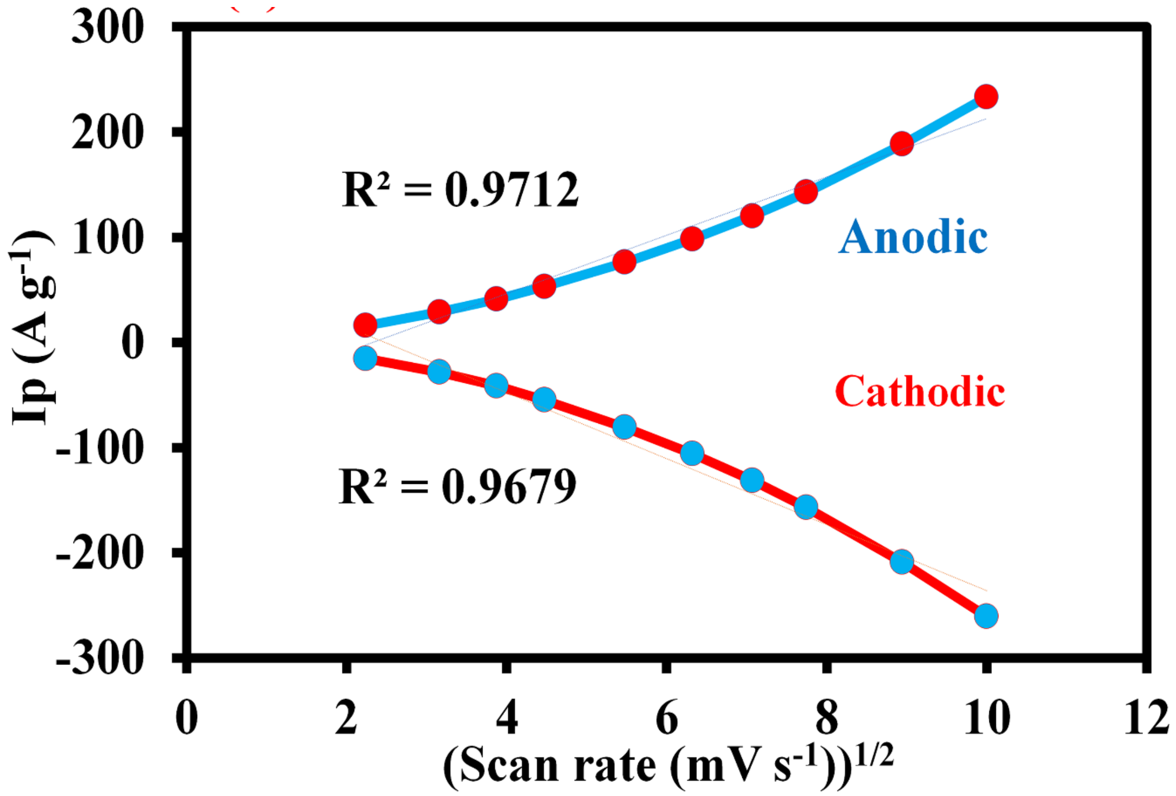

Figure S5. The plot of the anodic peak current density *vs*. the square root of the scan rate (ν);

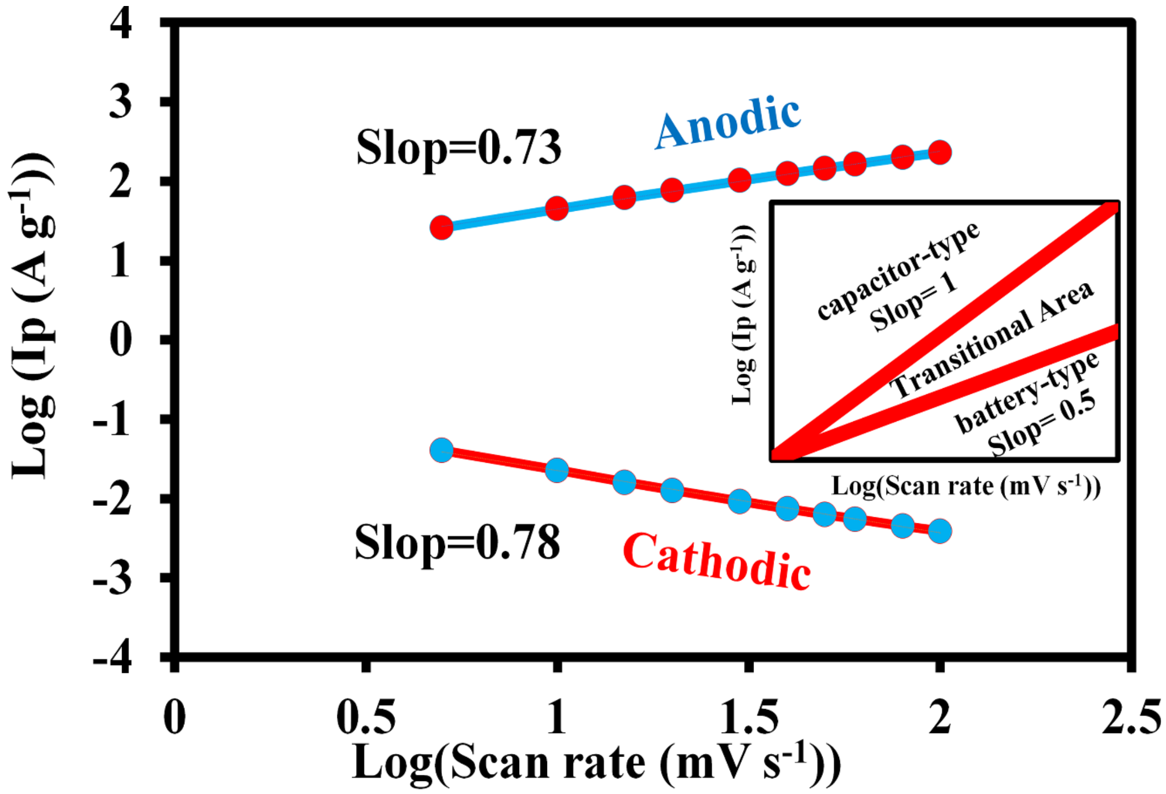

Figure S6. log I-log υ plot of the anodic and cathodic peak currents.

Table S2. Comparison of electrochemical performance of SC@NCC-BTC with some previous reports

Electrode	Three-electrode system		Two-electrode system		Specific power (W/kg)	Specific energy (Wh/kg)	Ref.
	Capacity (C/g)	Stability (cycles)	Capacity (F/g)	Stability (cycles)			
rGO-HKUST-1	385 F/g at 1 A/g	-	193 F/g at 1 A/g	4000, 98.5%	3100	42	1
HKUST-1/PANI	277 F/g at 1 A/g	-	19.93 F/g at 0.5 A/g,	2000, 87%	7497	6.22	2
L-rGO-C-MOF	390 C/g at 5 mV/s	5000, 97.8 %	-	-	8037.5	22.3	3
Cu−Ni−Ce−Co oxide@SS	1078 C/g at 1 A/g	3000, 86.5%	183.3 F/g at 1 A/g	3000, 92%	581.9	51	4
$CuCo_2S_4$@Ni−Mn LDH	1260 C/g at 1 A/g	10000, 94.3%	146.7 F/g at 2 A/g	10000, 87.6%	750	40.5	5
NCZF	457.2 C/g at 1 A/g	30000, 97.95%	222 F/g at 1 A/g	10000, 61.9%	800	49.3	6
Cu-MOF/G	192.8 C/g at 10 mV/s	1000, 93.8%	66 F/g at 0.5 A/g	-	1350	34.5	7
NiCoS@SBA-C	703 C/g at 1 A/g	5000, 78.57%	109.1 F/g at 1 A/g	5000, 94.59%	800	38.8	8
CCS	300 C/g at 1 A/g	-	122.9 F/g at 1 A/g	6000, 87.0 %	750	38.4	9
Cu@Ni@NiCoS NFs	6.94 µA h/cm^2 at 10 mV/s	10000, 89%	24.35 µA h/cm^3 at 1 A/g	10000, 92%	11.16 µW/cm^2	0.48 µW h/cm^2	10

Co-Ni-S NPs/Cu-Ni-Mn-O NSAs	263 mA h/g at 2 A/g	5000, 97.39%	121.51 mA h/g at 1 A/g	5000, 98.26%	6629.53	75.65	[11]
CCO@CC	973.6 C/g at 1 A/g	10000, 93.76%	182.7 F/g at 1 A/g	10000, 93.25%	749.75	57.1	[12]
Ni-Cu (OH)2@Ni-Cu-Se	158.95 F/g at 1 A/g	3000, 24.2 %	-	-	-	-	[13]
core–shell Cu_7S_4@Ni $(OH)_2$/CF	482.6 C/g at 1 A/g	10000, 94.5%	230.1 F/g at 1 A/g	10000, 68%	750 W/kg	52.5	[14]
SC@NCC-BTC	868 C/g 1 A/g	5000, 91.2%	168 F/g at 1 A/g	5000, 87.2%	1124	52.4	This work

References:

1 P. Srimuk, S. Luanwuthi, A. Krittayavathananon and M. Sawangphruk, *Electrochim. Acta*, 2015, **157**, 69–77.

2 E. A. Jafari, M. Moradi, S. Borhani, H. Bigdeli and S. Hajati, *Phys. E Low-Dimensional Syst. Nanostructures*, 2018, **99**, 16–23.

3 T. Van Ngo, M. Moussa, T. T. Tung, C. Coghlan and D. Losic, *Electrochim. Acta*, 2020, **329**, 135104.

4 L. Halder, A. Maitra, A. K. Das, R. Bera, S. K. Karan, S. Paria, A. Bera, S. K. Si and B. B. Khatua, *ACS Appl. Electron. Mater.*, 2019, **1**, 189–197.

5 J. Lin, H. Jia, H. Liang, S. Chen, Y. Cai, J. Qi, C. Qu, J. Cao, W. Fei and J. Feng, *Chem. Eng. J.*, 2018, **336**, 562–569.

6 X. Zhou, H. Dai, X. Huang, Y. Ren, Q. Wang, W. Wang, W. Huang and X. Dong, *Mater. Today Energy*, 2020, **17**, 1–8.

7 M. Azadfalah, A. Sedghi and H. Hosseini, , DOI:10.1007/s11664-019-07505-y.

8 Y. Chen, C. Jing, X. Fu, M. Shen, K. Li, X. Liu, H. C. Yao, Y. Zhang and K. X. Yao, *Chem. Eng. J.*, 2020, **384**, 123367.

9 L. He, J. Liu, L. Yang, Y. Song, M. Wang, D. Peng, Z. Zhang and S. Fang, *Electrochim. Acta*, 2018, **275**, 133–144.

10 B. S. Soram, I. S. Thangjam, J. Y. Dai, T. Kshetri, N. H. Kim and J. H. Lee, *Chem. Eng. J.*, 2020, **395**, 125019.

11 C. V. V. M. Gopi, R. Vinodh, S. Sambasivam, I. M. Obaidat, S. Singh and H. J. Kim, *Chem. Eng. J.*, 2020, **381**, 122640.

12 Y. Chen, H. Hu, N. Wang, B. Sun, M. Yao and W. Hu, *Chem. Eng. J.*, 2019, 123536.

13 V. T. Chebrolu, B. Balakrishnan, V. Raman, I. Cho, J. S. Bak, K. Prabakar and H. J. Kim, *Appl. Surf. Sci.*, 2020, **506**, 145015.

14 Y. Zhou, S. Zhao, X. Yu, Y. Li, H. Chen and L. Han, *Inorg. Chem. Front.*, 2020, **7**, 427–436.