

Supplementary Materials for

Viability of Carbon Derived from Polystyrene Sulphonate Beads as Electrical Double Layer Capacitors.

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1.0. SEM Study

The shape of the carbon spheres was not affected after activation as seen in Figure S1 (a-c). The shape is more preserved with little or no breakage of beads at this pyrolysis temperature. The carbon spheres are of regular shape and size and no change was observed after activation.

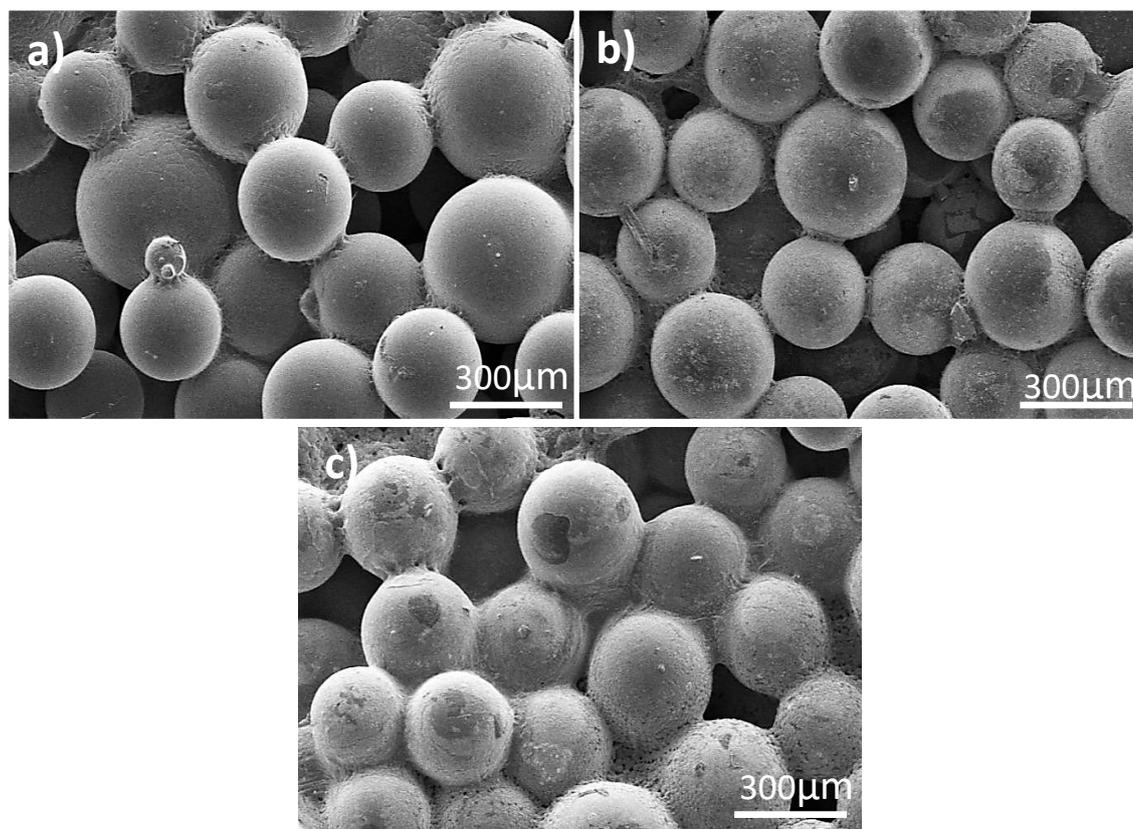


Figure S1. SEM micrographs of (a) ACS-700-0.1 (b) ACS-700-0.3 (c) ACS-700-0.5

1.2. XRD and XPS Studies

CS 700 activated at different FeCl_3 concentrations (0.1, 0.3 and 0.5 M) was studied by XRD as shown in Figure S2 (a). XRD pattern showed the normal diffraction peak of graphitic carbon with distinctive peaks of iron observed at $2\theta = 31^\circ$, 35° and 45° [1]. The iron peak intensities in the material become prominent as its concentration increases. The sharp diffraction peak at 101/100 plane also shows that the material dissolved in the crystal structure of the additive [2]. Furthermore, XPS analysis was also conducted to verify the successful introduction of Fe into our material. Figure S2 (b) shows that ACS-700-0.1 and ACS-700-0.3 have two obvious peaks of Fe 2p centered at 711.4 and 723.22 eV respectively while little peak is observed in ACS-700-0.5. The peak that appears at 711.4 eV and 723.22 eV belongs to Fe (II) 2p_{3/2} and can be assigned to Fe (II) 2p respectively [3]. From the XPS analysis, the atomic content of Fe and Cl for ACS-700-0.1 is 3.04 and 80.70 %, ACS-700-0.3 is 2.51 and 84.38 %, and ACS-700-0.5 is 0.16 and 94.24 % respectively.

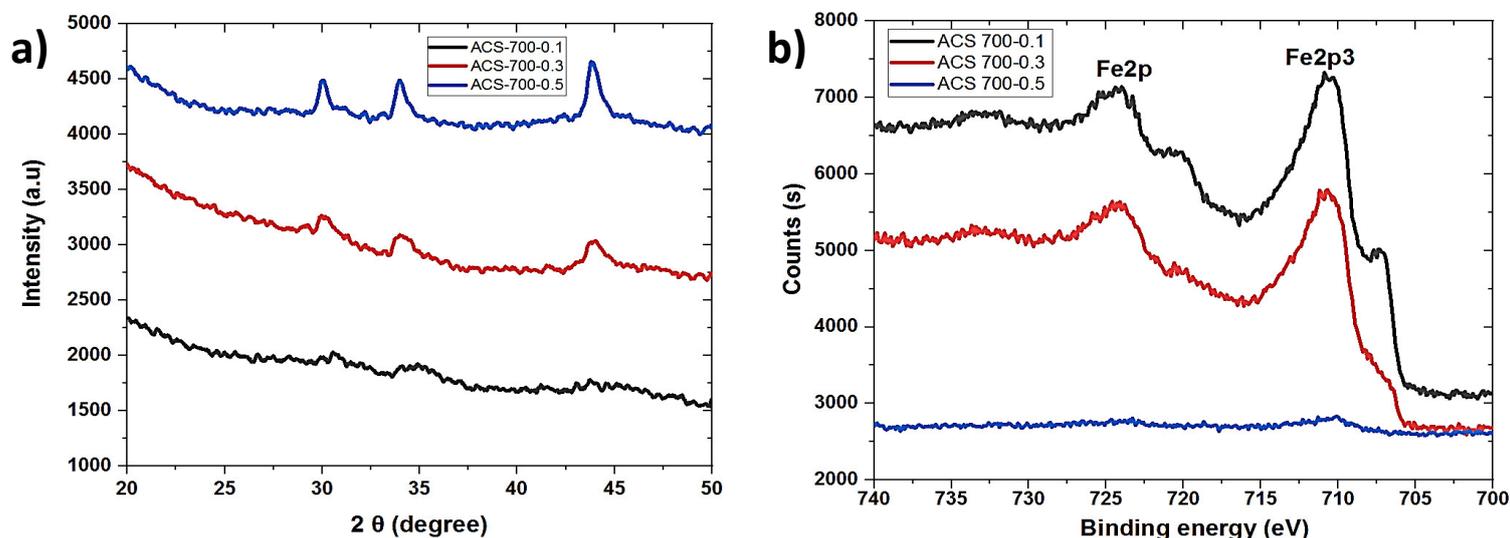


Figure S2. (a) XRD of ACS 700-0.1, ACS 700-0.3 and ACS 700-0.5 (b) XPS spectra of Fe 2p of ACS 700-0.1, ACS 700-0.3 and ACS 700-0.5

Table SI1 presents the elemental composition of our materials by energy dispersive x-ray spectroscopy (EDX). Evidently from table SI1, the elements detected at highest percentage in our materials are C and O and other elements in little quantity. The presence of Fluorine was also detected due to the addition of PVDF (binder) added in the course of electrode fabrication.

Table S1. Elemental composition of CS obtained from pyrolysis of polymer resin at 700, 800 and 900 ° C.

	C	O	Fe	F	Cl	Zn	Na	S
CS 700 Wt.%	73.70	9.27	-	10.72	0.59	0.35	0.58	1.27
At.%	82.53	7.79	-	7.59	0.34	0.07	0.34	0.53
CS 800 Wt.%	68.91	3.19	-	25.21	1.11	-	0.60	0.98
At.%	78.04	2.71	-	18.05	0.42	-	0.35	0.42
CS 900 Wt.%	58.51	2.98	-	34.98	1.83	-	1.02	0.68
At.%	69.43	2.65	-	26.24	0.73	-	0.63	0.30
ACS 700-0.1 Wt.%	57.53	3.91	20.47	3.91	0.15	-	0.11	13.92
At.%	79.17	4.04	6.06	3.40	0.07	-	0.08	7.18
ACS 700-0.3 Wt.%	63.92	4.89	8.33	16.50	0.27	-	0.24	5.85
At.%	77.74	4.46	2.18	12.69	0.11	-	0.15	2.66
ACS 700-0.5 Wt.%	73.61	3.69	2.83	12.62	0.39	-	0.24	6.62
At.%	83.93	3.16	0.69	9.10	0.15	-	0.14	2.83

1.3 Electrochemical Studies

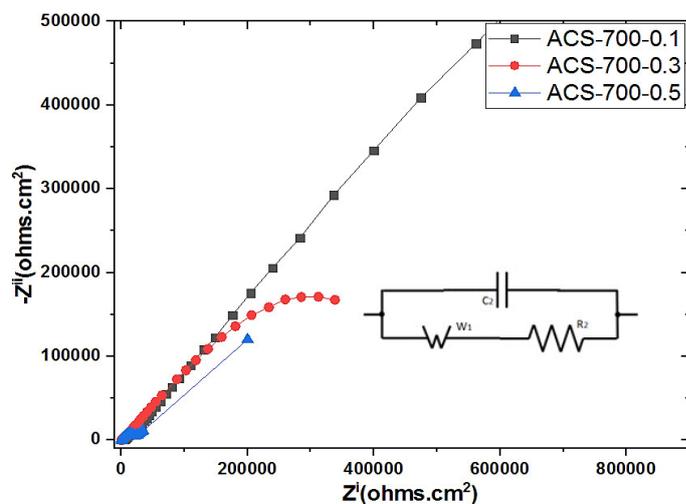


Figure S3. Nyquist plot of activated CS 700 at 0.1 M (ACS-700-0.1), 0.3 M (ACS-700-0.3) and 0.5 M (ACS-700-0.5) FeCl₃

References

1. Uzun, E. Production of ferric complex compounds for wastewater treatment from hot rolled iron-steel solid waste. *TIJMET* **2019**, *2*, 01-07.
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3. Xue, Q.W.; Ping, W.; Ping, N.; Yi, X.M.; Fei, W.; Xiao, L.G.; Yi, L. Adsorption of gaseous elemental mercury with activated carbon impregnated with ferric chloride. *RSC Adv.* **2015**, *5*, 24899–24907.