Supporting Information

Pore Structure Improvement of Carbon Aerogel and Investigation of Supercapacitive Behavior of Co_3O_4 Nanoball /Carbon Aerogel Composite

Majid zomorodian esfahani[a], Alireza Aghaei[*a], Mohsen Khosravi[b], Narjes Bagheri[c], Zahra Khakpour[a] and Masoumeh javaheri[a]

[a]*Ceramic Division, Materials and Energy Research Center, P.O. Box 31787-316, Karaj, Iran.*

[b]*Department of Nanotechnology Engineering, Faculty of Advanced Science and Technologies, University of Isfahan, Isfahan, 81744-73441, Iran.*

[c]*Non-metallic Research Group & Center of Nanotechnology Development, Niroo Research Institute (NRI).*

*E-mail addresses: a-aghaei@merc.ac.ir (A. Aghaei)

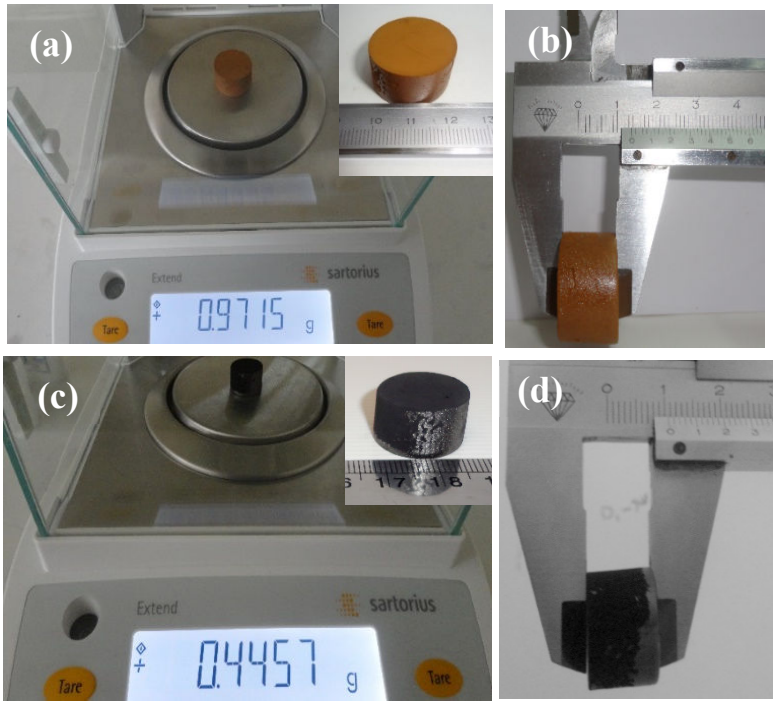

Fig. S1: digital images of OA1, before (a, b) and after carbonization (c, d), the weight measurement process shows the carbon aerogel weight after carbonization of 0.44 g with volume of 2.851 cm^3 (ρ= 0.15 g cm^{-3}).

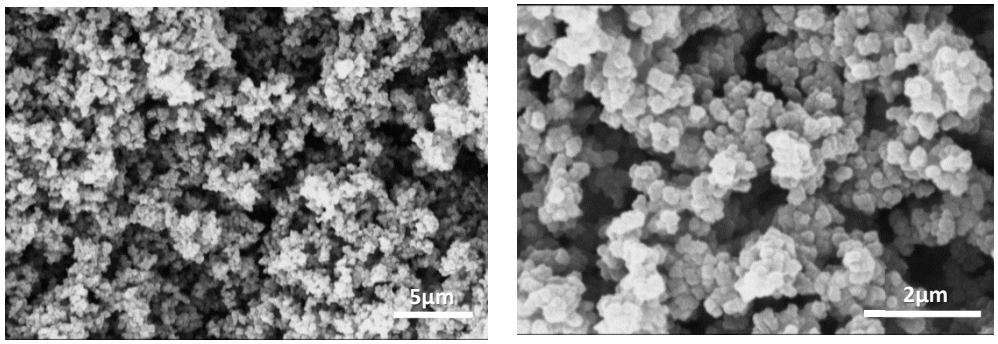

Fig. S2: FE-SEM images of CA2 sample.

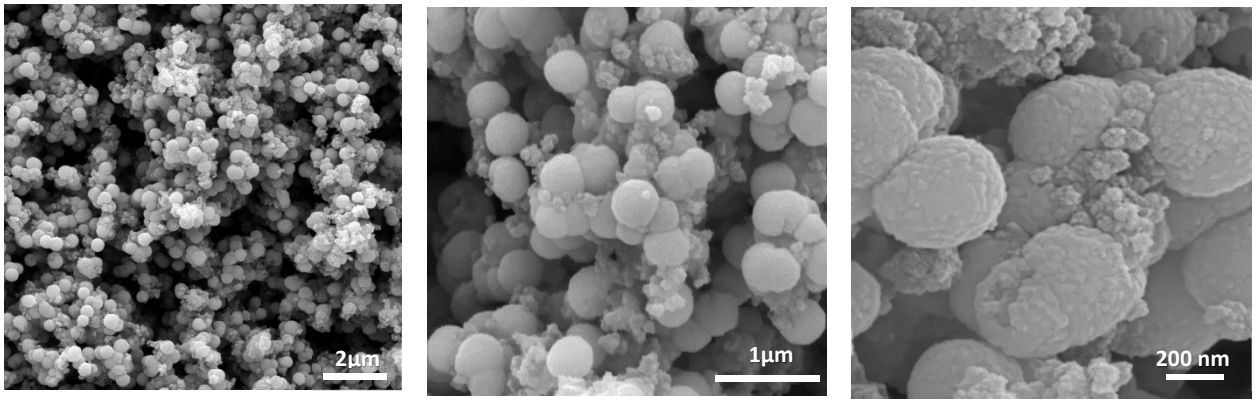

Fig. S3: Additional FE-SEM images of Co_3O_4 nanoballs anchored CA1.

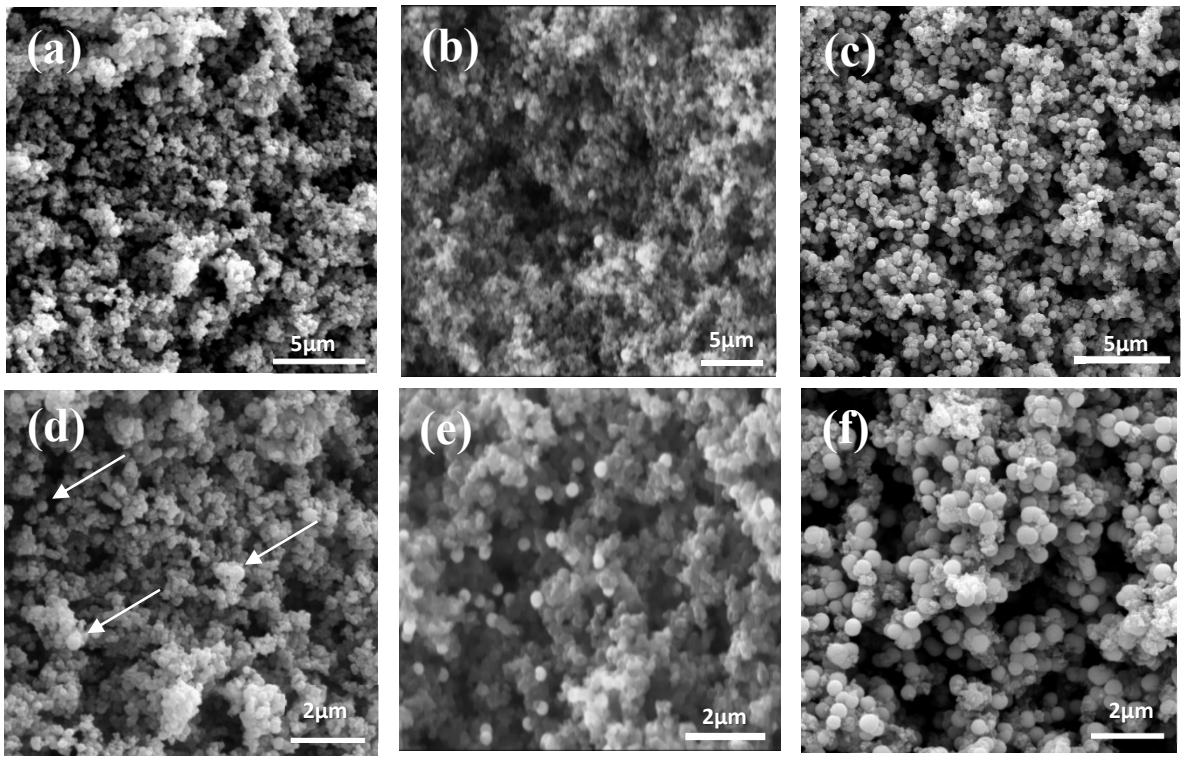

Fig. S4: FE-SEM images of Co_3O_4 nanoballs anchored CA2 (a, d-b, e) and CA1 (c, f), for comparison. Arrows shows Co_3O_4 nanoball.

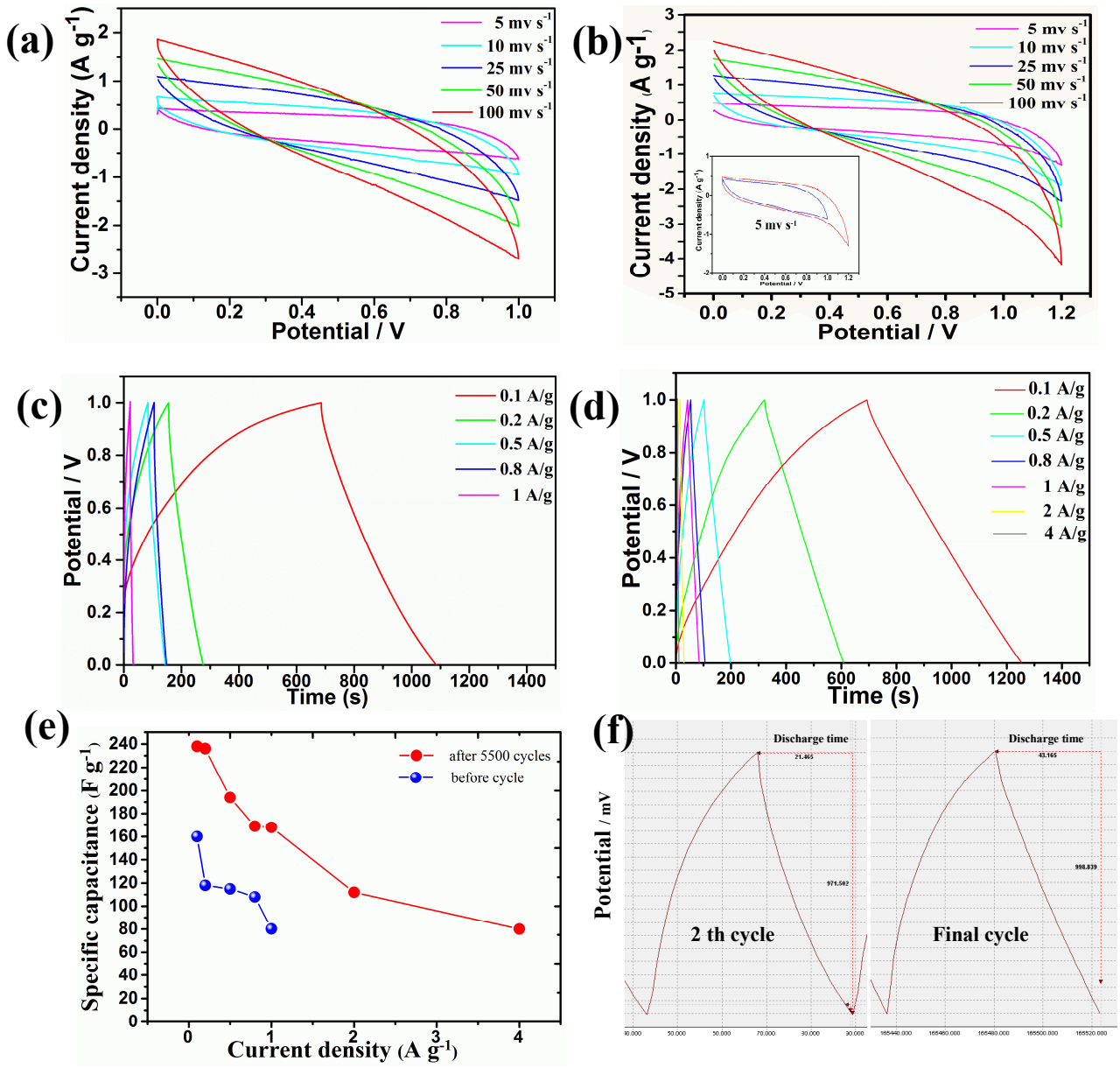

Fig. S5: Cyclic voltammograms of symmetric two-electrode supercapacitor at different scan rates (a, b) and collected at different voltage windows (b, inset). Galvanostatic charge/discharge curves of CAC2 at various current densities before cycling test (c). Galvanostatic charge/discharge curves of CAC2 at various current densities after 5500 cycles (d). The specific capacitance of CAC2 as a function of current density (e). Galvanostatic charge/discharge curves of CAC2 at a current density of 1 Ag^{-1} in 2 th cycle and final cycle (6000 th cycle), indicates increase in the discharge time of final cycle (these graphs are retrieved from the software of *Analyzer* version 7.0.9) (f).

Table S1: Comparison of Pore structure properties of carbon aerogels.

Sample	S_{BET} $(\frac{m^2}{gr})$	V_{total} $(\frac{cm^3}{gr})$	V_{mic} $(\frac{cm^3}{gr})$	V_{meso} $(\frac{cm^3}{gr})$	Drying method	ref
CA1	**907**	**6.26**	**0.35**	**4.86**	Infrared dryer setup	This work
CA2	**477**	**0.44**	**0.13**	**0.14**	Microwave drying	This work
CA-K-A1000	**2796**	**1.89**	**1.33**	**NC**	Ambient pressure drying	[1]
CA-A1000	**2139**	**1.00**	**0.81**	**NC**	Ambient pressure drying	
CA-K-A900	**1403**	**0.64**	**0.58**	**NC**	Ambient pressure drying	
CA900	**1005**	**1.2**	**0.54**	**0.66**	Ambient pressure drying	[2]
CA900-A	**1539**	**1.7**	**0.71**	**0.99**	Ambient pressure drying	
CA-A3	**752**	**NC**	**0.15**	**1.33**	Hot supercritical drying	[3]
CA#1	**669**	**5.6**	**0.33**	**1.9**	Cold supercritical drying	[4]
CA-SC-A1000	**2617**	**1.7**	**0.92**	**NC**	Cold supercritical drying	[5]

Where S_{BET}, V_{mic}, V_{mes}, V_{total} are BET surface area, volume of micro and mesopores and total pore volume respectively.

K-A refers to chemical and thermal activation, respectively.

NC refers to “the data are not calculated

Table S2. Synthetic methods and capacitances of the previously reported Co3O4 / carbon-based supercapacitors and Co3O4 nanoball/CA composites in our work.

Material	**Synthetic method**	**Current Density**	**Potential window (ΔV)**	**Capacitance (F g^{-1})**	**Reference**
CNT@1600-Co3O4/CC	ALD (atomic layer deposition)	1-10 (mA cm^{-2})	0.7	350-225	[6]
Co3O4/C-800 °C	precipitation	1-20 (A g^{-1})	0.5	~200-195	[7]
PSAC/Co3O4 Nps	Hydrothermal method	1-10 (A g^{-1})	0.45	~ 100-50	[8]
NCA/ Co3O4 Nps	precipitation	1-10 (A g^{-1})	0.4	~ 600-450	[9]
RGOA/ Co3O4 Nps	Solvothermal process	0.5-10 (A g^{-1})	0.5	~ 650-500	[10]
Mesoporous Co3O4/Carbon	Solvothermal process	0.5-5 (A g^{-1})	0.6	~ 400-175	[11]
needle-like Co3O4 /GNS	Hydrothermal method	0.1-1 (A g^{-1})	0.6	~160-63	[12]
Nanoball Co3O4 /CA	Hydrothermal method	0.8-10 (A g^{-1})	0.7	~350-185.7	This work

Table S3: Electrochemical characteristics of the Co_3O_4 nanoball /carbon aerogel symmetric two-electrode supercapacitor after cycling performance.

Current density ($A\ g^{-1}$)	Specific Capacitance ($F\ g^{-1}$)	Energy Density ($W\ h\ Kg^{-1}$)	Power Density ($W\ Kg^{-1}$)	Coulombic efficiency-η (%)
0.1	**232.4**	**32.22**	**55.55**	**83.69**
0.2	**236.05**	**32.77**	**111.1**	**91.90**
0.5	**194.3**	**26.94**	**277.7**	**96.03**
0.8	**169.1**	**23.47**	**442.8**	**98.14**
1	**168.2**	**23.33**	**555.5**	**97.6**
2	**112.7**	**15.5**	**1107**	**100**
4	**80.2**	**11.11**	**2222**	**100**

Reference

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