

Supplementary information:

Applicability of Atmospheric Plasma Jet (APPJ) discharge for the reduction of Graphene Oxide films and synthesis of the Carbon nanomaterials.

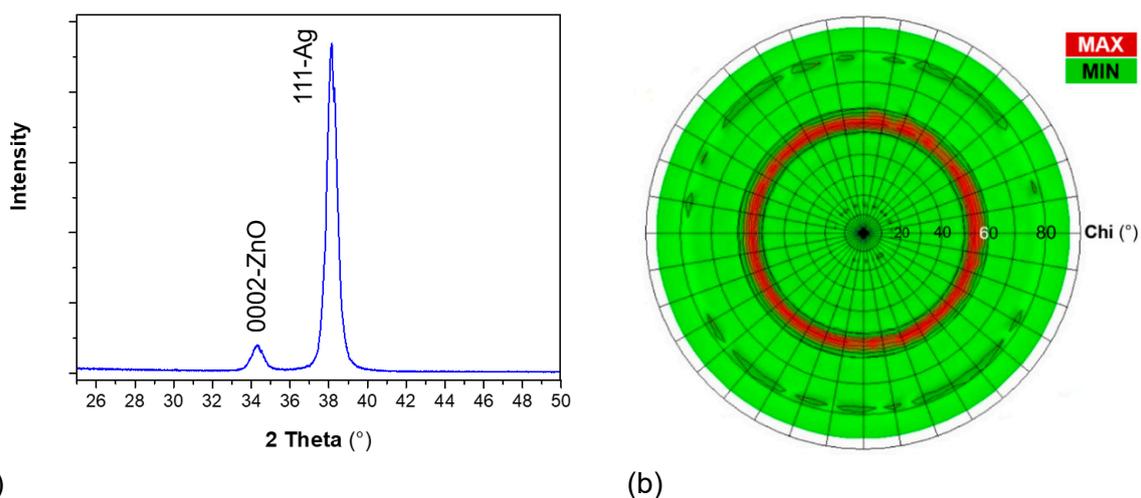


Figure S1*. XRD pattern obtained in symmetric θ - 2θ -scanning for the ZnO / Ag substrates used for the carbon APPJ-deposition. (b) Pole-figure measured for the ZnO / Ag substrate at $2\theta=44.1^\circ$. This angle corresponds to the (200)-Ag diffraction maximum.

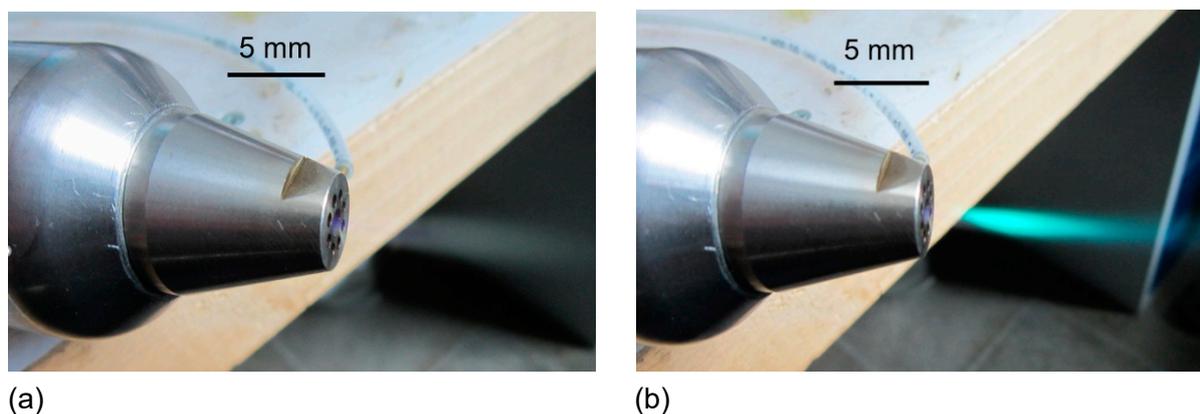


Figure S2*. Photographs of the APPJs used in this work. (a) with 10% vol. H_2 / 90% vol. N_2 gas flow; (b) with centered feeding of C_2H_2 gas in a H_2 / N_2 working jet.

Table S1*. Parameters extracted from the fitted Raman spectra for GO and various rGO on Si substrates. rGO-RF-30s and its reference GO sample (indicated by †) were measured with 633 nm laser excitation, while the remaining were measured with 532 nm laser excitation. Note that the Raman spectra of the rGO-APPJ-5s sample deviated from that of GO which is discussed in the manuscript.

Sample	Parameter	D-band	G-band	D'-band	D''-band	D*-band
GO	position (cm ⁻¹)	1349	1589	1617	1479	1263
	FWHM (cm ⁻¹)	104	66	39	179	118
	intensity	0.90	0.74	0.47	0.18	0.05
rGO-APPJ-2s	position (cm ⁻¹)	1345	1585	1613	1480	1288
	FWHM (cm ⁻¹)	98	64	36.8	133	116
	intensity	0.97	0.68	0.59	0.13	0.05
rGO-APPJ-5s*	position (cm ⁻¹)	1342	1587	1615	1430*	1530*
	FWHM (cm ⁻¹)	113	57	37	62	11
	intensity	0.98	0.60	0.65	0.54	0.02
GO †	position (cm ⁻¹)	1322	1570	1600	1483	1196
	FWHM (cm ⁻¹)	112	61	39	191	137
	intensity	0.96	0.47	0.44	0.16	0.05
rGO-RF-30s †	position (cm ⁻¹)	1313	1569	1595	1489	1217
	FWHM (cm ⁻¹)	105	60	37	119	72
	intensity	0.98	0.47	0.44	0.08	0.06

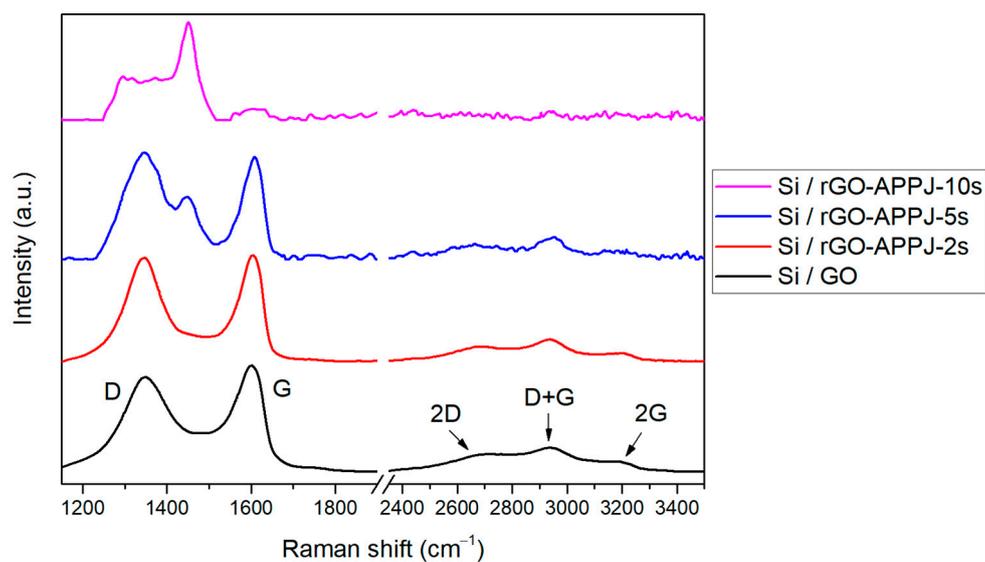


Figure S3*. Raman spectra for the GO and rGO reduced with the APPJ on Si substrates.

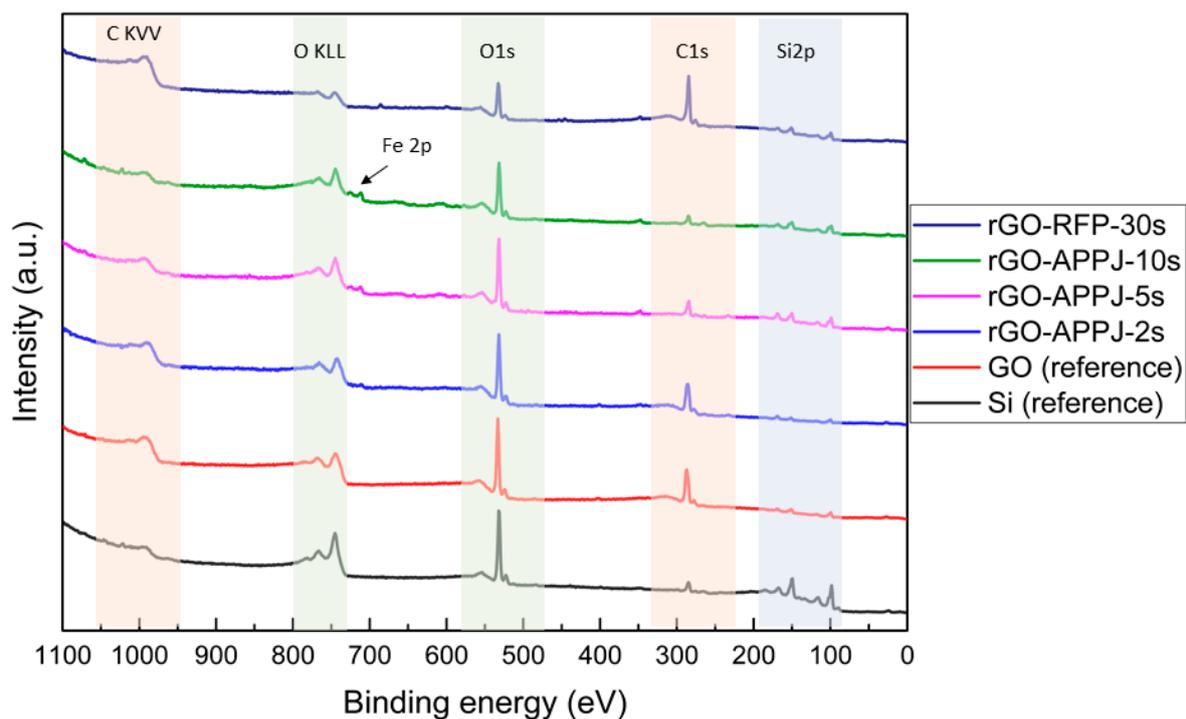


Figure S4*. XPS survey spectra for Si substrate, GO reference and various rGO.

Table S2*. Parameters extracted from the fitted Raman spectra for carbon deposited on ZnO\Ag substrates. Samples were measured with a 633 nm laser excitation.

Sample	Parameter	D-band	G ⁻ -band	G ⁺ -band	D2-band	D3-band	D4-band	D''-band
Ag-C-D3-1S	position (cm ⁻¹)	1325	1544	1560	1605	1487	1173	–
	FWHM (cm ⁻¹)	174	56	41	39	205	290	–
	intensity	0.37	0.07	0.20	0.17	0.14	0.09	–
Ag-C-D3-2S	position (cm ⁻¹)	1321	1574	1595	1611	1502	1176	1076
	FWHM (cm ⁻¹)	124	65	35	24	151	48	90
	intensity	0.99	0.21	0.55	0.32	0.16	0.10	0.03
Ag-C-D6-1S	position (cm ⁻¹)	1326	1561	1589	1609	1493	1180	1095
	FWHM (cm ⁻¹)	159	86	48	37	89	108	59
	intensity	0.96	0.23	0.39	0.35	0.25	0.11	0.04
Ag-C-D6-2S	position (cm ⁻¹)	1323	1571	1595	1615	1492	1197	–
	FWHM (cm ⁻¹)	111	69	38	25	154	79	–
	intensity	0.98	0.18	0.52	0.29	0.14	0.07	–

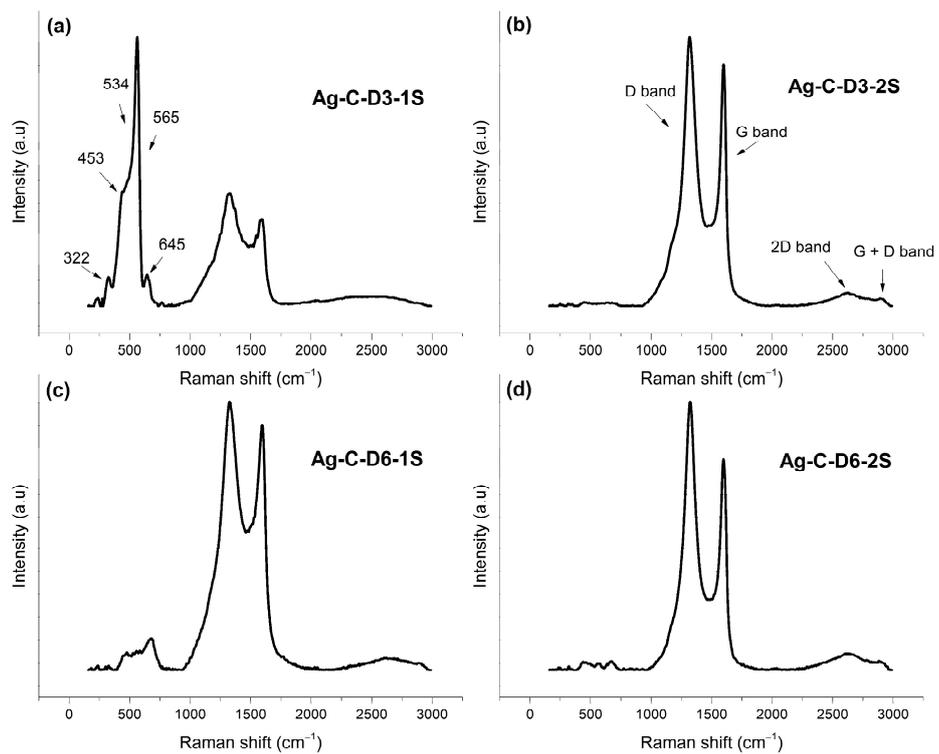


Figure S5*. Raman spectra of the carbon deposited on ZnO/Ag substrates for various time and various nozzle distance: (a) at 3 mm for 1 s, (b) at 3 mm for 2 s, (c) at 6 mm for 1 s, and (d) at 6 mm for 2 s.

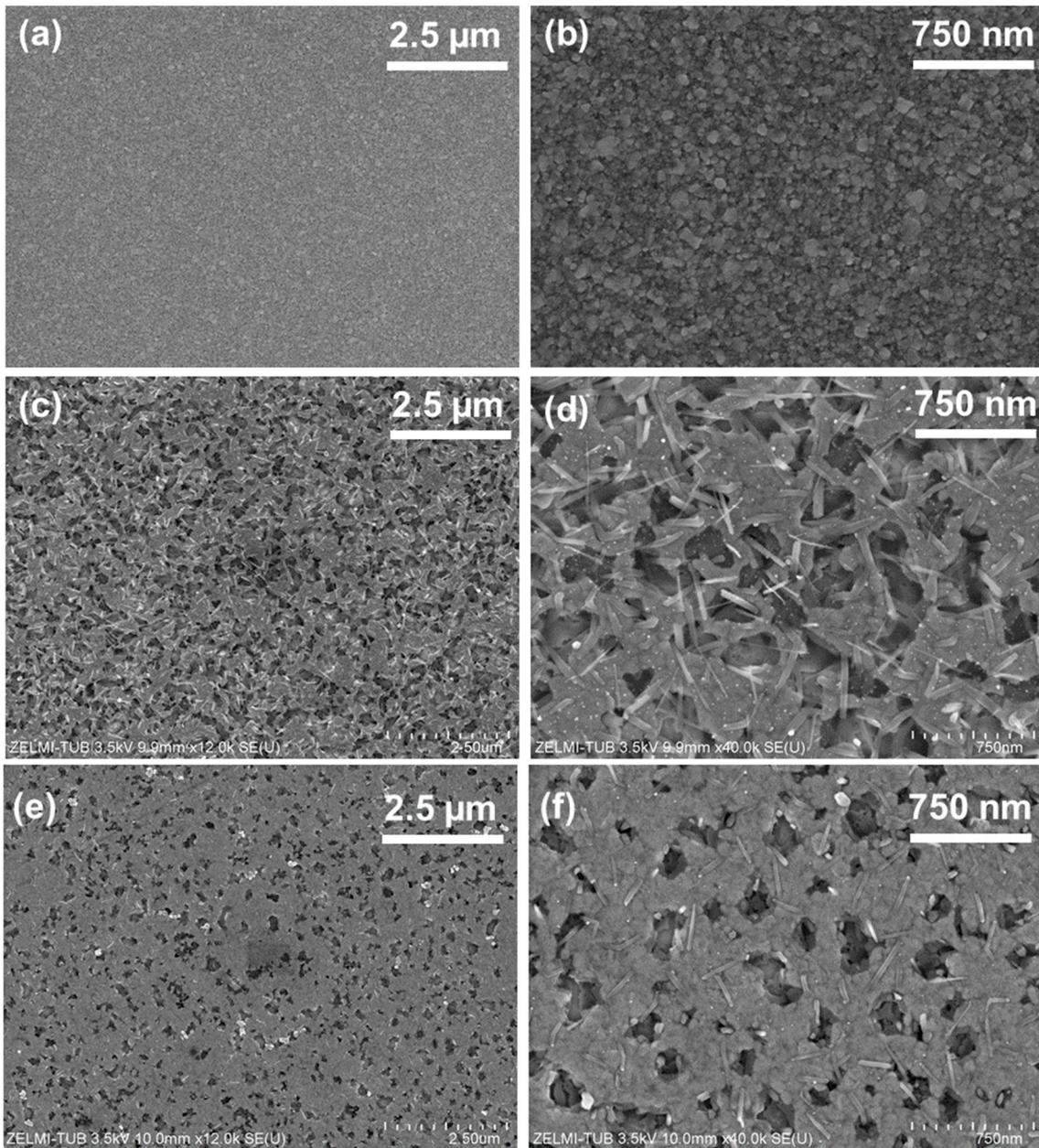


Figure S6*. SEM images of the ZnO/Ag substrate (a–b), Ag–C–D3–1s (c–d), Ag–C–D3–2s (e–f).

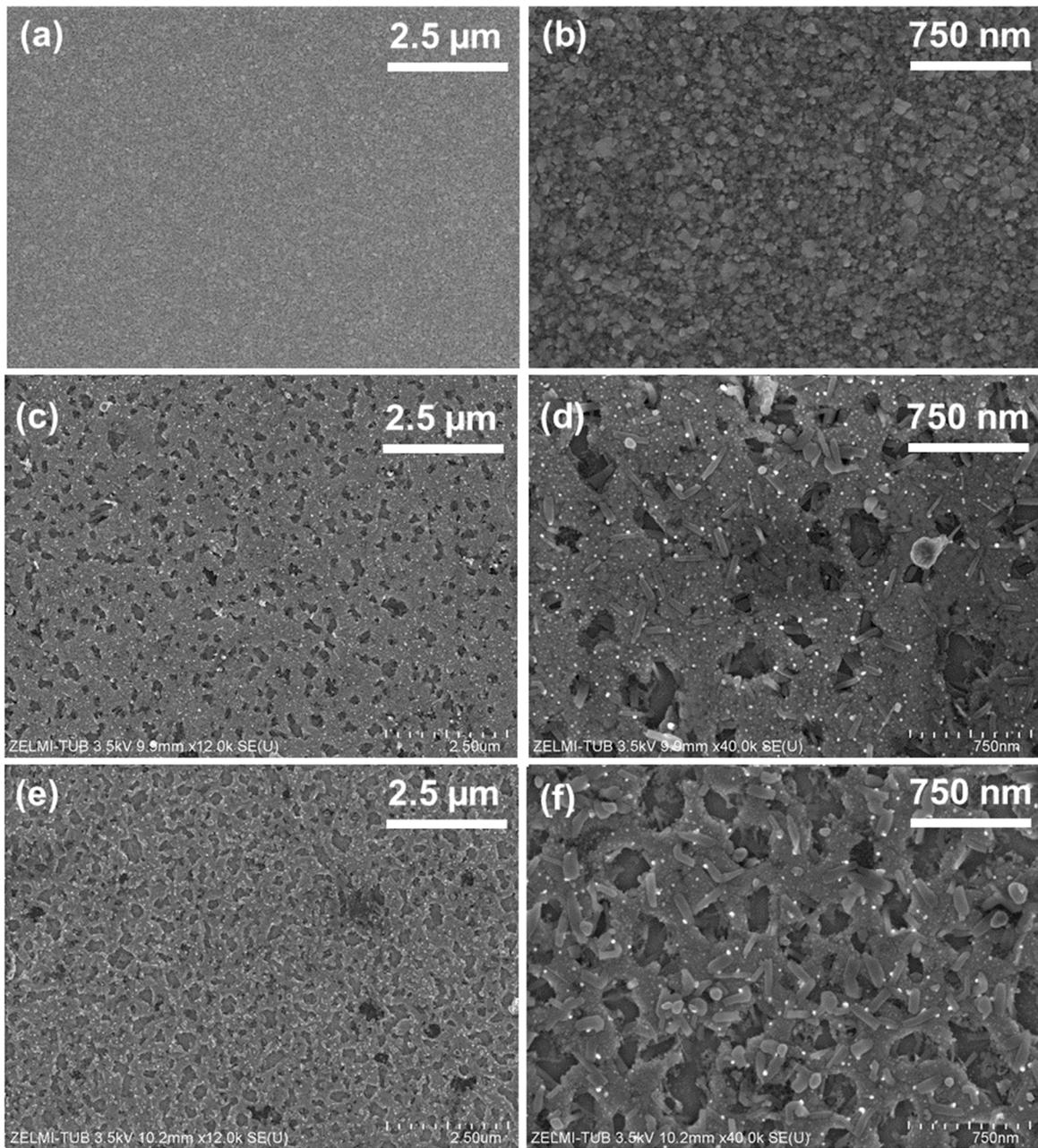


Figure S7*. SEM images of the ZnO / Ag substrate (a-b), Ag-C-D6-1s (c-d), and Ag-C-D6-2s (e-f).

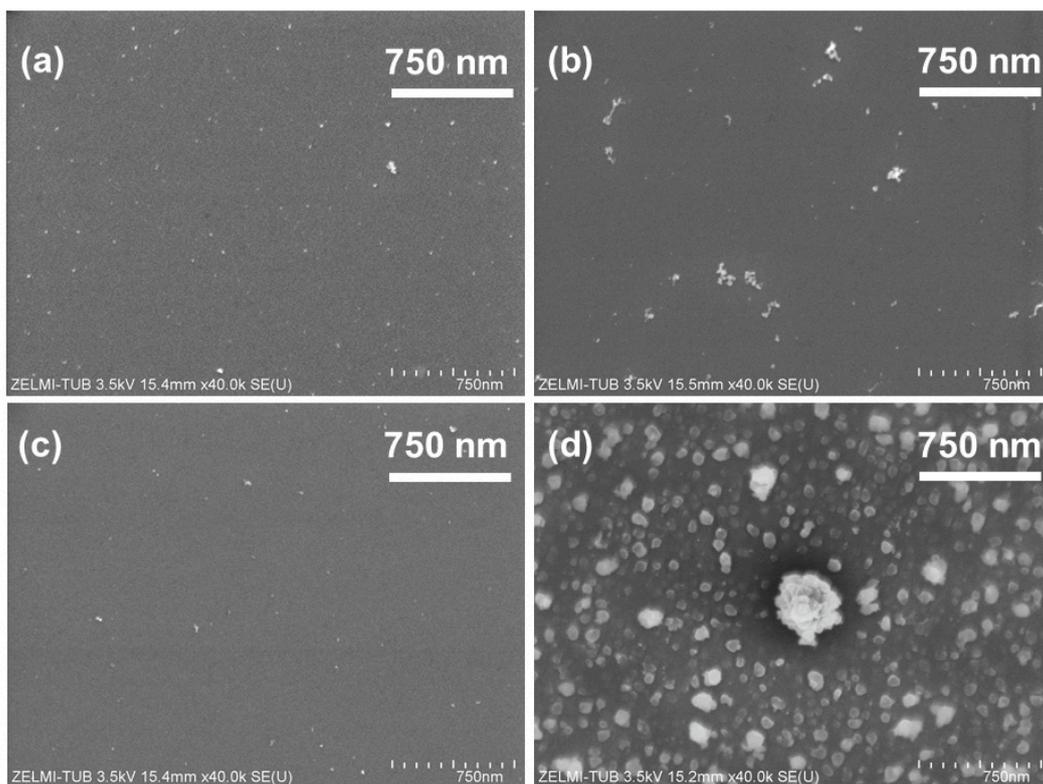


Figure S8*. SEM images of carbon deposited on Si substrates for various time: 5 s (a), 10 s (b), 20 s (c), and 30 s (d).