Laser Fabrication of Hybrid Electrodes Composed of Nanocarbons Mixed with Cerium and Manganese Oxides for Supercapacitive Energy Storage

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SUPPORTING MATERIAL

Table S1. Average thickness of the fabricated electrodes.

Dispersion	**Thickness (µm)**
GO-Ce	1.4 ± 0.2
CNT-Ce	1.2 ± 0.1
GO-CNT-Ce-515	1.7 ± 0.2
GO-CNT-Ce-525	1.1 ± 0.1
GO-CNT-Ce-Mn-5151	1.3 ± 0.2
GO-CNT-Ce-Mn-5152	1.3 ± 0.2
GO-CNT-Ce-Mn-5155	1.4 ± 0.3

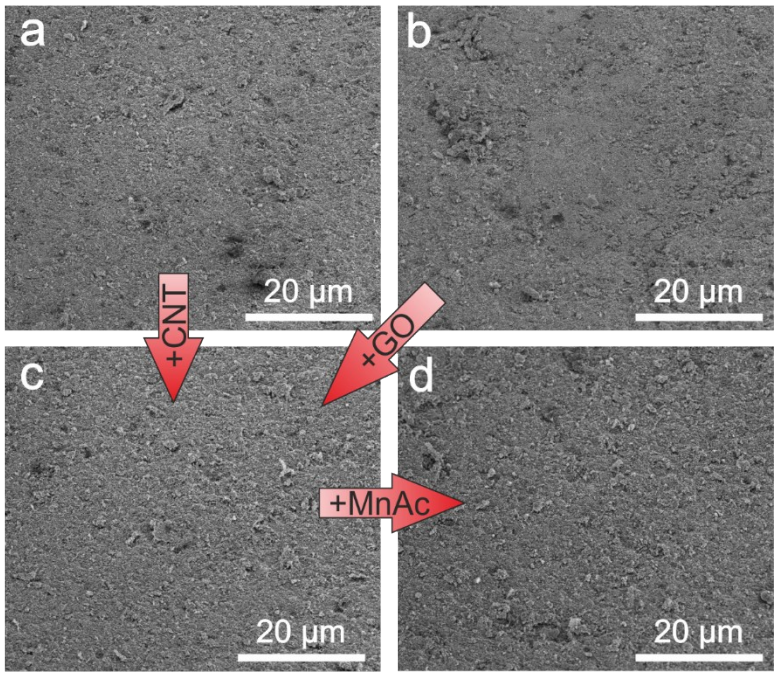

Figure S1. XHRSEM images at 5000x of a) GO-Ce, b) CNT-Ce, c) GO-CNT-Ce-515, and d) GO-CNT-Ce-Mn-5151.

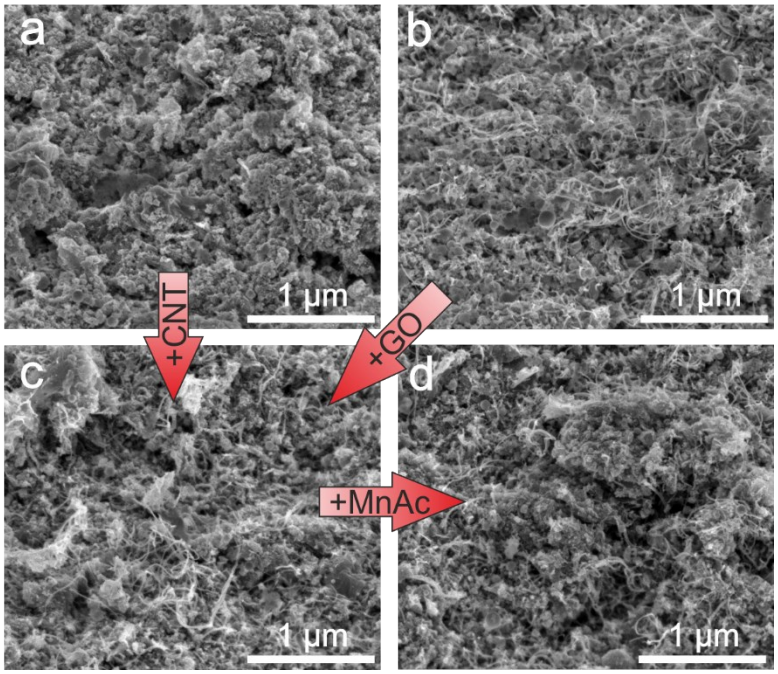

Figure S2. XHRSEM images at 100000x of a) GO-Ce, b) CNT-Ce, c) GO-CNT-Ce-515, and d) GO-CNT-Ce-Mn-5151.

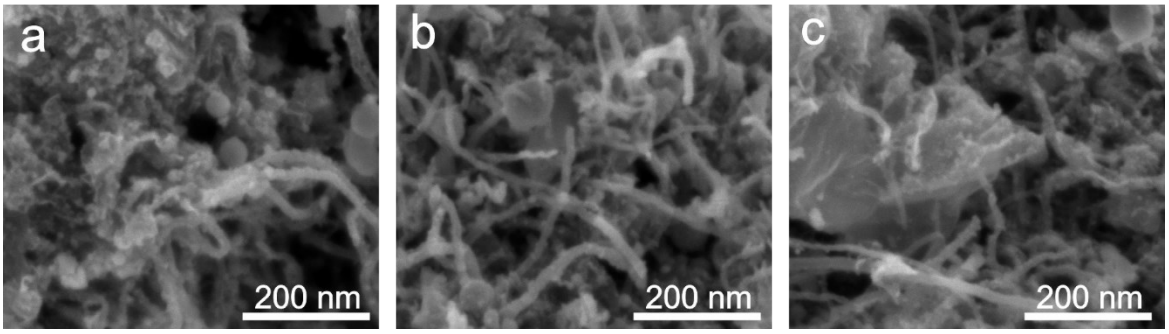

Figure S3. XHRSEM images at 500000x of a) GO-CNT-Ce-Mn-5151, b) GO-CNT-Ce-Mn-5152, and c) GO-CNT-Ce-Mn-5155.

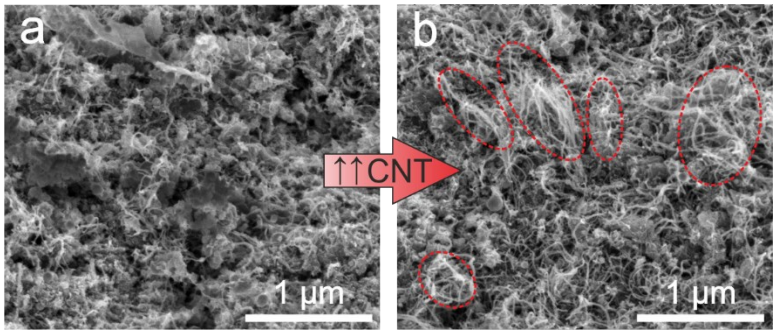

Figure S4. XHRSEM images at 100000x of a) GO-CNT-Ce-515, and b) GO-CNT-Ce-525. Regions with agglomerated CNTs are indicated.

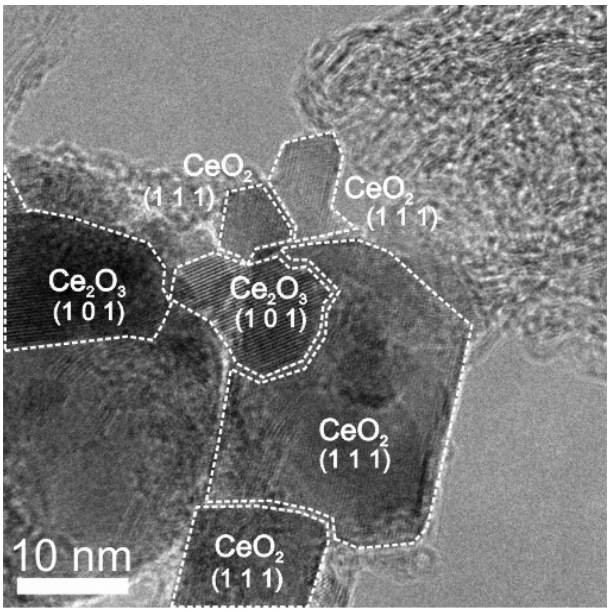

Figure S5. HRTEM of GO-CNT-Ce-515 with highlighted different crystalline regions.

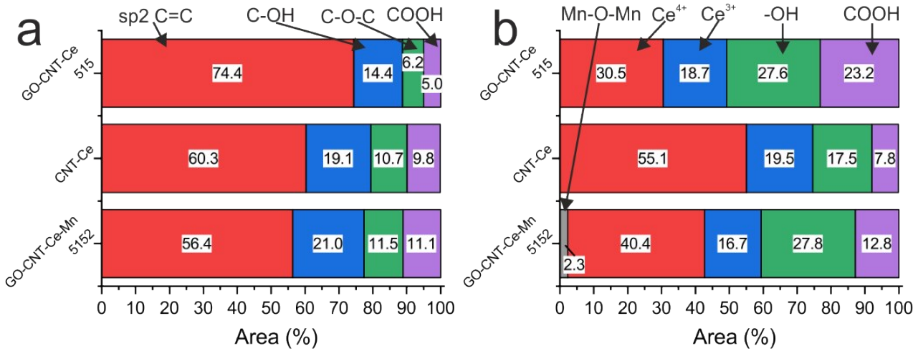

Figure S6. Integrated area of XPS a) C1s and b) O1s high resolution spectra.

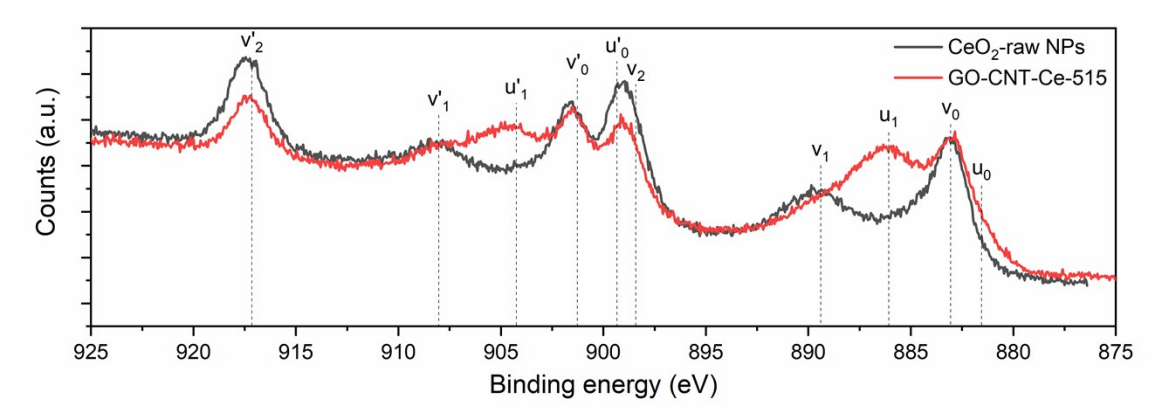

Figure S7. Ce $3d_{3/2}$ and Ce $3d_{5/2}$ high resolutions XPS of CeO_2-raw nanoparticles and GO-CNT-Ce-515 for comparison.

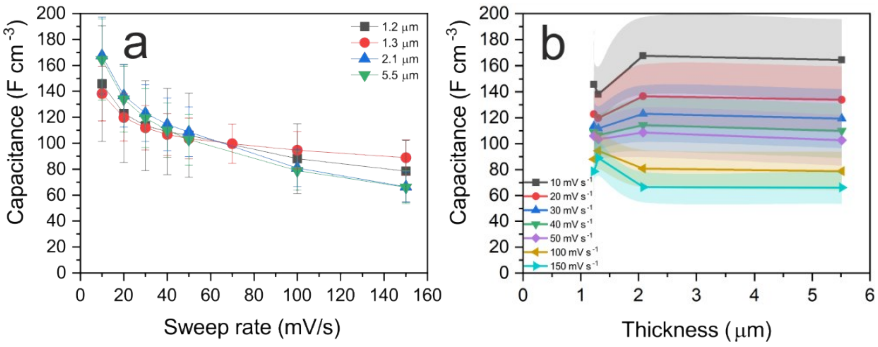

Figure S8. a) Volumetric capacitance vs sweep rate of GO-CNT-Ce-Mn-5152 for diverse thicknesses and b) volumetric capacitance vs thickness for different sweep rates.

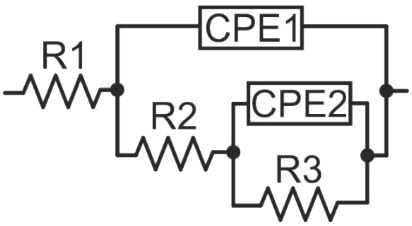

Figure S9 Equivalent circuit for data fitting

Table S2. Fitting values for the elements of the equivalent circuit.

				CPE1		CPE2	
	R1 (Ω)	**R2 (Ω)**	**R3 (Ω)**	**Y (µS s^n)**	**n**	**Y (µS s^n)**	**n**
GO-Ce	13.4	51.4	886.1	25.8	0.82	36.0	0.84
CNT-Ce	15.4	225.3	10991	14.2	0.85	52.8	0.89

GO-CNT-Ce-515	13.8	30.7	1881.3	38.1	0.83	25.5	0.94
GO-CNT-Ce-525	14.4	25.7	2564.1	23.3	0.84	22.9	0.91
GO-CNT-Ce-Mn-5151	17.5	64.8	1659.9	16.3	0.86	63.6	0.87
GO-CNT-Ce-Mn-5152	15.1	63.3	1855.3	14.4	0.87	77.8	0.84
GO-CNT-Ce-Mn-5155	15.2	525.8	6447.4	10.6	0.88	83.0	0.88