

Supplementary materials

Supplementary Table T1. Quality criteria parameters of the RhE tissues used to assess skin irritation (OECD TG 439) and skin corrosion (OECD TG 431) of the tested GRMs.

	Mean OD of 3 negative controls		Mean viability of 3 positive controls*		ET ₅₀ (h)	
	Measured criteria	Acceptability range	Measured criteria (%)	Acceptability range	Measured criteria**	Acceptability range
OECD TG 439	1.15 ± 0.08	≥0.8 and ≤3.0	1.9 ± 0.6	≤ 40%	6.05 ± 0.85	4.0 – 10.0
OECD TG 431	1.76 ± 0.07	≥0.8 and ≤3.0	1.2 ± 0.8	≤ 15%	8.35 ± 1.01	4.0 – 10.0

OD: Optical density at 570 nm

ET₅₀: Exposure time required to reduce tissue viability by 50% upon application of benchmark chemicals

* For OECD TG 439: viability of RhE exposed to positive control (5% SDS) evaluated by the MTT assay; for OECD TG 431: viability of RhE exposed to positive control (8N KOH) evaluated by the MTT assay.

** Values given by the supplier (Episkin; Lyon, France).

Supplementary Table T2. ICP-MS analyses of GNP. SD = Standard Deviation, RSD = Relative Standard Deviation, LOQ = Limit of Quantification.

	Element	[µg/mL]	SD [µg/mL]	RSD (%)
GNP	55Mn	7.70	0.88	11.46
	57Fe	1734.00	114.04	6.58
	59Co	1.25	0.03	2.58
	60Ni	< LOQ		
	63Cu	21.56	1.12	5.18

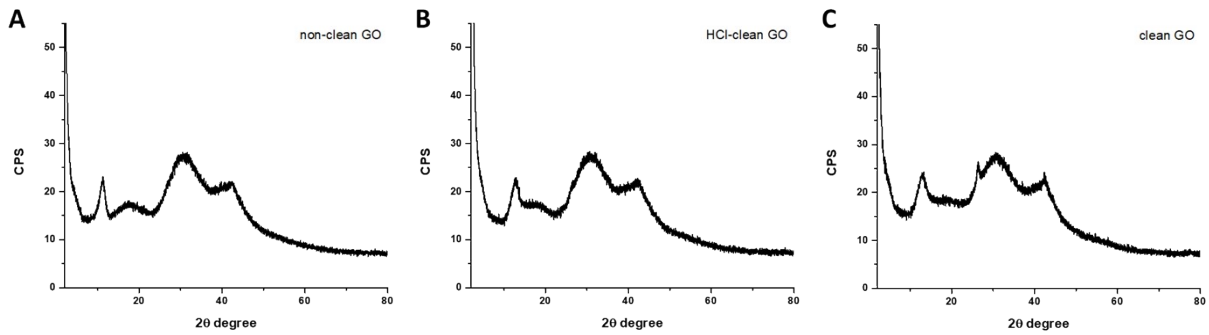
Supplementary Figure S1. XRD spectra of non-clean GO (A), HCl-clean GO (B) and clean GO (C). Number of layers was calculated with the following formula:

$$n = \left(\frac{L_c}{d} \right) + 1$$

, where n is the number of layers, L_c is the mean crystallite size and d is the interlayer space.

d was calculated applying the Bragg's Law: $d = \left(\frac{\lambda}{\sin\theta} \right) / 2$, where λ is 1.5418 Å (X-ray wavelength) and θ is the position of the characteristic peak of GO, that corresponds to its (002) plane.

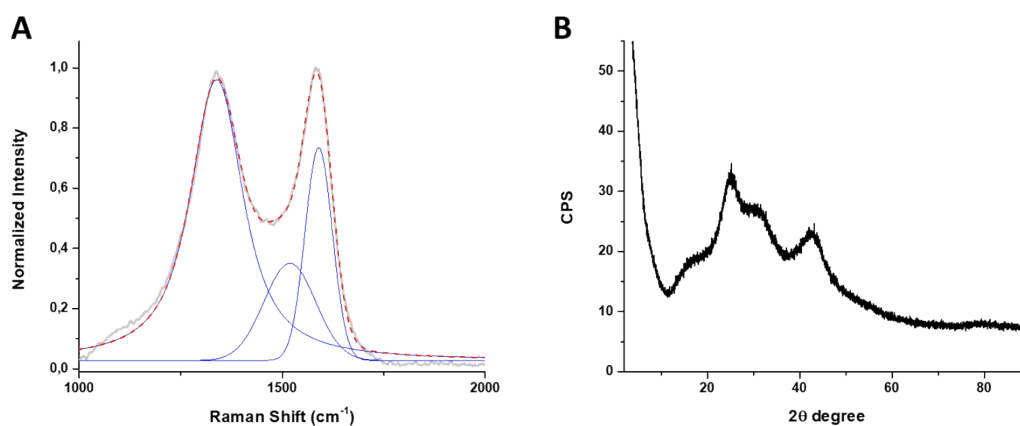
L_c was calculated using the Scherrer formula: $L_c = \frac{K\lambda}{\beta \cos\theta}$, where $K = 0.89$, λ is 1.5418 Å, β is the full width at half maximum of the characteristic peak of GO in radians and θ is the position of the characteristic peak of GO.



Supplementary Table T3. ICP-MS analyses of non-clean GO, HCl-clean GO and clean GO. *SD* = Standard Deviation, *RSD* = Relative Standard Deviation, *LOQ* = Limit of Quantification.

	Element	[$\mu\text{g/mL}$]	SD [$\mu\text{g/mL}$]	RSD (%)
Non-clean GO	55Mn	1469.46	94.56	6.43
	57Fe	2890.80	196.78	6.81
	59Co	27.93	1.92	6.88
	60Ni	282.43	23.78	8.42
	63Cu	12.65	4.02	31.74
HCl-clean GO	55Mn	69.01	5.10	7.39
	57Fe	2690.95	105.23	3.91
	59Co	6.24	0.55	8.86
	60Ni	239.89	15.36	6.40
	63Cu	61.37	2.44	3.97
Clean GO	55Mn	58.10	0.72	1.24
	57Fe	1882.13	153.87	8.18
	59Co	3.71	0.81	21.88
	60Ni	106.82	2.47	2.31
	63Cu	< LOQ		

Supplementary Figure S2. Physico-chemical characterization of Carbon Black (CB). (A) Raman spectrum with the fitting for the peak of amorphous carbon. (B) XRD spectrum. (C) ICP-MS analyses. *SD = Standard Deviation, RSD = Relative Standard Deviation, LOQ = Limit of Quantification.*



C	Element	[$\mu\text{g/mL}$]	SD [$\mu\text{g/mL}$]	RSD (%)
Carbon Black	55Mn	< LOQ		
	57Fe	5.25	12.62	240.41
	59Co	0.37	0.10	26.20
	60Ni	< LOQ		
	63Cu	< LOQ		

Supplementary Table T4. ICP-MS analyses of MWCNTs Nanoamor and MWCNTs Nanocyl. *SD = Standard Deviation, RSD = Relative Standard Deviation, LOQ = Limit of Quantification.*

	Element	[$\mu\text{g/mL}$]	SD [$\mu\text{g/mL}$]	RSD (%)
MWCNTs Nanoamor	55Mn	13.78	3.38	24.53
	57Fe	443.27	58.28	13.15
	59Co	72.85	10.34	14.20
	60Ni	6562.09	723.08	11.02
	63Cu	< LOQ		
MWCNTs Nanocyl	55Mn	< LOQ		
	57Fe	12786.85	334.06	2.61
	59Co	4099.22	42.24	1.03
	60Ni	< LOQ		
	63Cu	< LOQ		