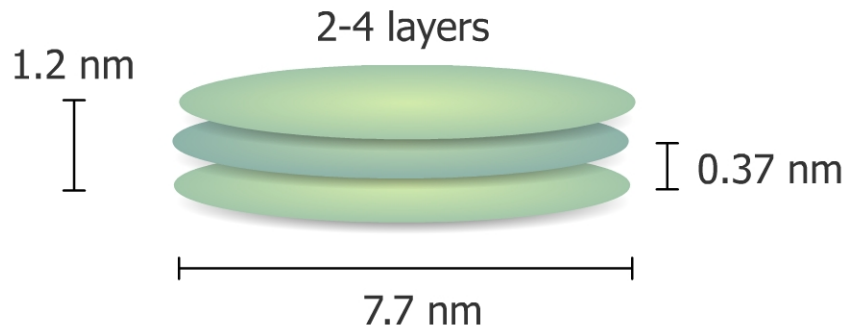


Few Layer Reduced Graphene Oxide (FL-RGO) platelets (flakes) show stack structure of up to 10 monolayers of reduced graphene oxide. It is free of the oxygen containing groups. The single FL-RGO flake size ranges between a few nanometers to a dozen micrometers and the interlayer distance varies from 0.36 to 0.50 nm. This highly hydrophobic, black material has a low resistivity with the band gap of the order of meV. It does not form stable aqueous suspensions.

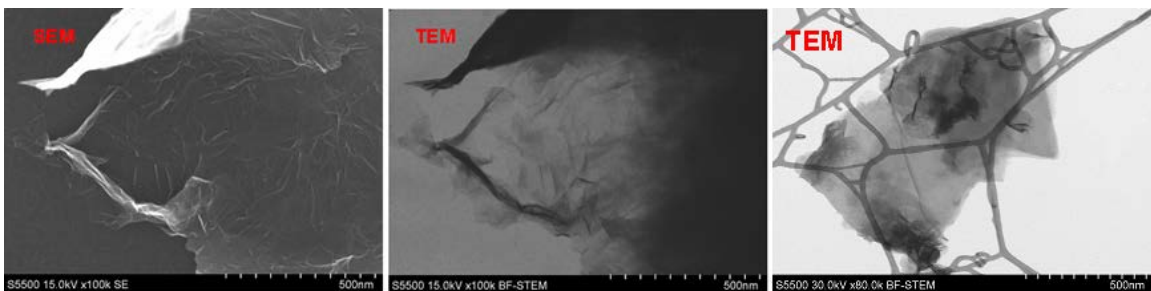
Model of FL-RGO platelet

The average values are calculated from the XRD patterns. FL-RGO reveals stacking nanostructure of 7.7 nm (diameter) x 1.2 nm (height) with a distance of 0.37 nm between 2-4 graphene layers (for graphite, relevant distance is 0.335 nm).

Model of FL-RGO platelete



STEM of FL-RGO



(A. Matolepszy, M. Mazurkiewicz et.al., WIM PW)

Analysis of trace impurities with XRF (X-ray Fluorescence)

FL-RGO powder:

Cl(0.3%)>Mn(0.2%)>S(0.01%)=K(0.01%)=Fe(0.01%)>Ca(0.009%)>
Cu(0.006%)>Ni(0.001%)

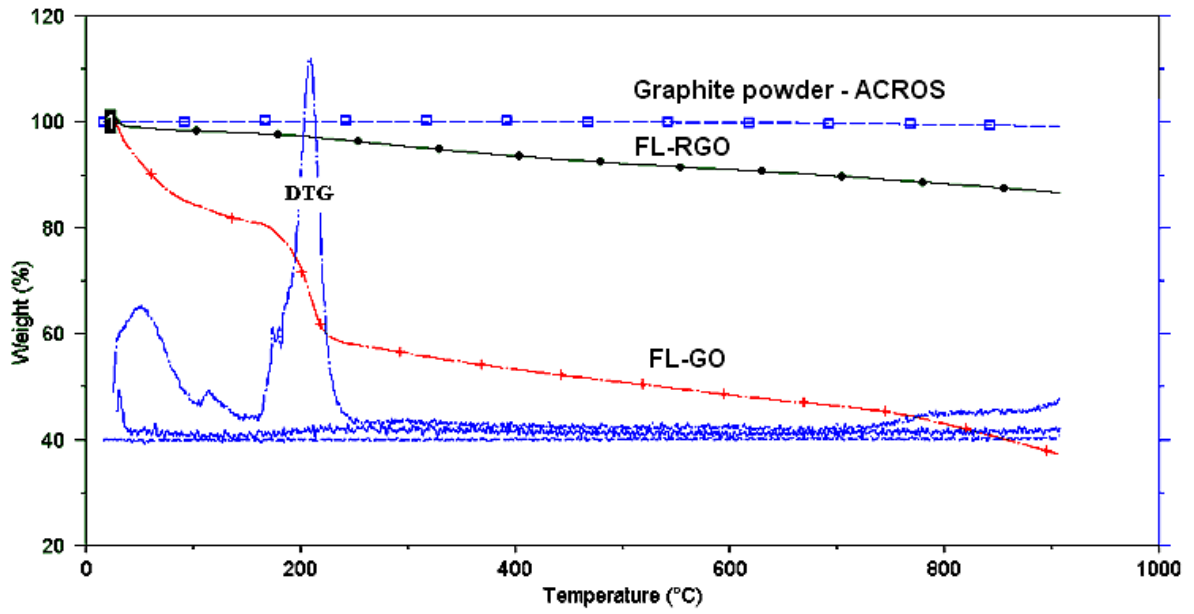
(D. Lisovytskiy et.al., IChF PAN)

C,H,N elemental analysis

Sample	Analysis	C wt. %	N wt. %	H wt. %	O and others wt %
Graphite power (ACROS)	1	99,97	0,009	0,172	0
	2	99,98	0,015	0,150	0
FL-GO	1	45,44	0,112	2,193	~48 wt % O
	2	45,29	0,192	2,495	~4 wt % others
FL-GRO	1	85,69	3,088	1,056	~9,59 wt % O
	2	85,81	3,126	0,993	~0,6 wt % others

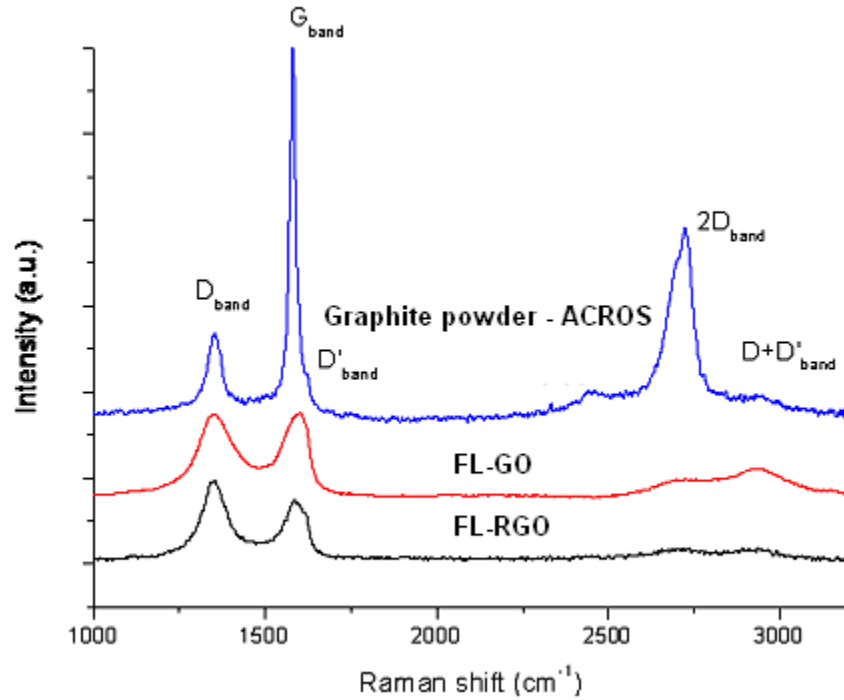
(G. Trykowski et.al., WCh UMK)

Thermogravimetric analysis (TGA) for graphite, FL-GO and FL-RGO



(G. Trykowski et.al., WCh UMK)

Raman spectroscopy

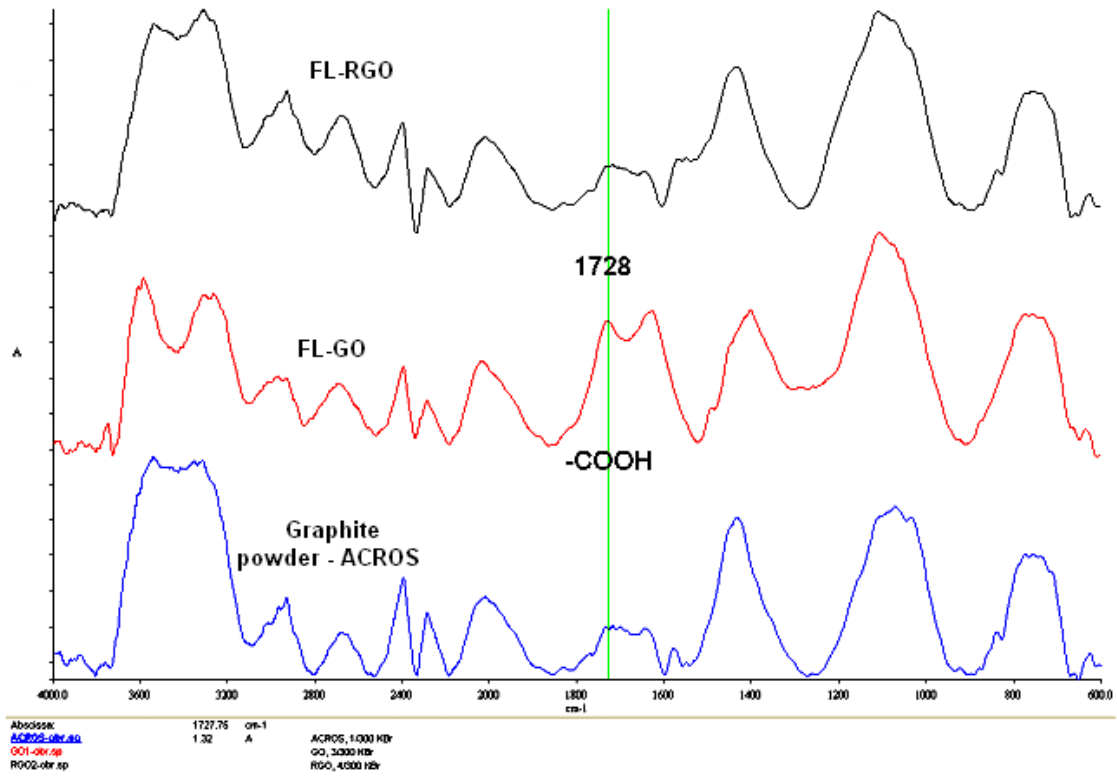


Sample	D position	D FWHM	G position	G FWHM	I_D/I_G	D' position	I_G/I_D	2D position	2D FWHM	I_G/I_{2D}
Graphite ACROS	1352	59	1580	21	0,20	1621	20,56	2686/ 2725	61/ 51	2,61
FL-GO	1353	127	1560	70	1,87	1604	0,69	2701	178	4,61
FL-RGO	1351	83	1582	63	1,48	1612	2,79	2714	199	4,59

FWHM - full width at half maximum

(M. Mazurkiewicz, A. Małolepszy et.al., WIM PW)

FTIR spectroscopy



(G. Trykowski et.al., WCh UMK)

XPS analysis

Sample	Concentration (at %)	
	O	C
FL-GO	30,3	69,7
FL-RGO	25,8	73,0
Graphite ACROS	4,4	95,6

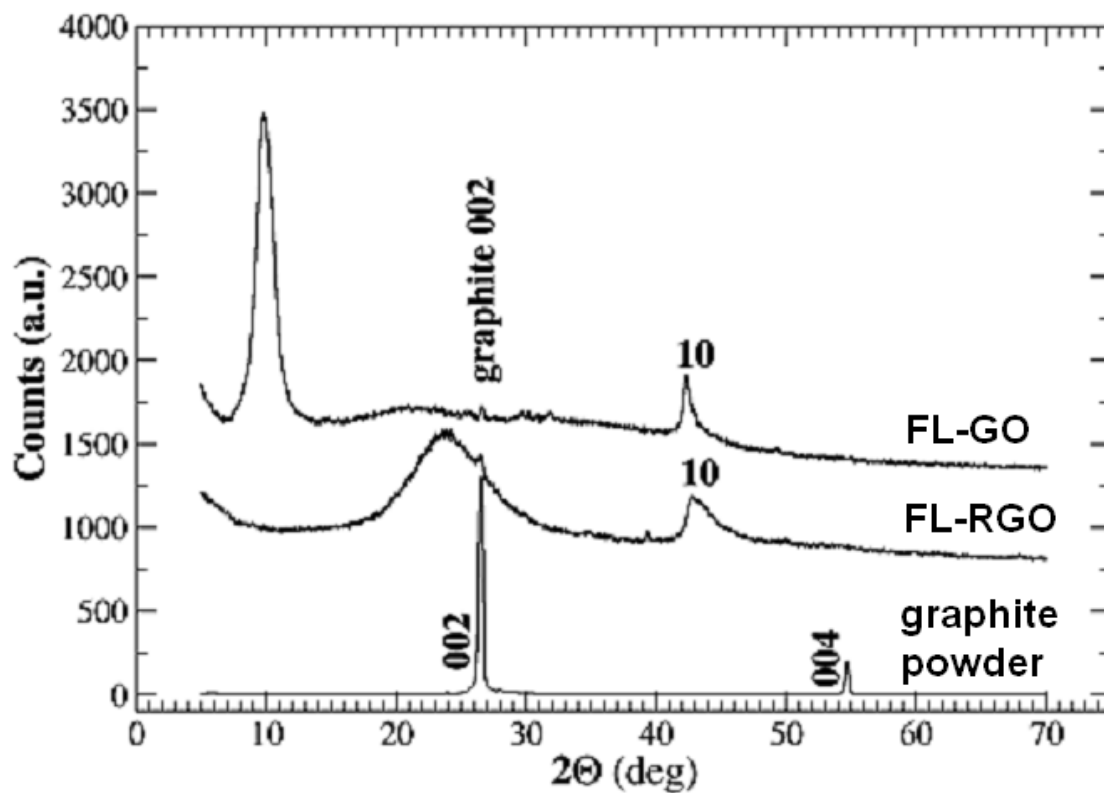
(B. Lesiak-Orlowska et.al., IChF PAN)

C and O atomic content in functional groups in FL-GO, FL-RGO and graphite by XPS

Sample	C 1s group content (at%) – (BE (eV))					
	C_{sp²} 284.5 eV	C_{sp³} 285.2 eV	C-OH 286.4 eV	C-O-C 287.1 eV	C=O 288.0 eV	C-OOH 289.2 eV
FL-GO	4.8	29.5	7.7	20.5	4.9	2.3
FL-RGO	30.5	20.3	9.1	5.5	2.7	4.9
Graphite ACROS	70.2	17.6	6.3	0	1.5	0
Sample	O 1s group content (at%) – BE (eV)					
	H₂O	C-OH (532.9 eV)	C-O-C (533.1 eV)	C=O	in carboxyl group C=O (531.9 eV) C-O (534.2 eV)	
FL-GO	2.0 – 535.0 eV	6.2	16.4	3.9 – 532.4 eV	1.8	
FL-RGO	5.5 – 535.6 eV	8.3	5.1	2.5 – 531.2 eV	4.4	
Graphite ACROS	0.3 – 535.1 eV	3.3	0	0.8 – 531.2 eV	-	

(B. Lesiak-Orlowska et.al., IChF PAN)

XRD analysis



(B. Mierzwa et al., IChF PAN)