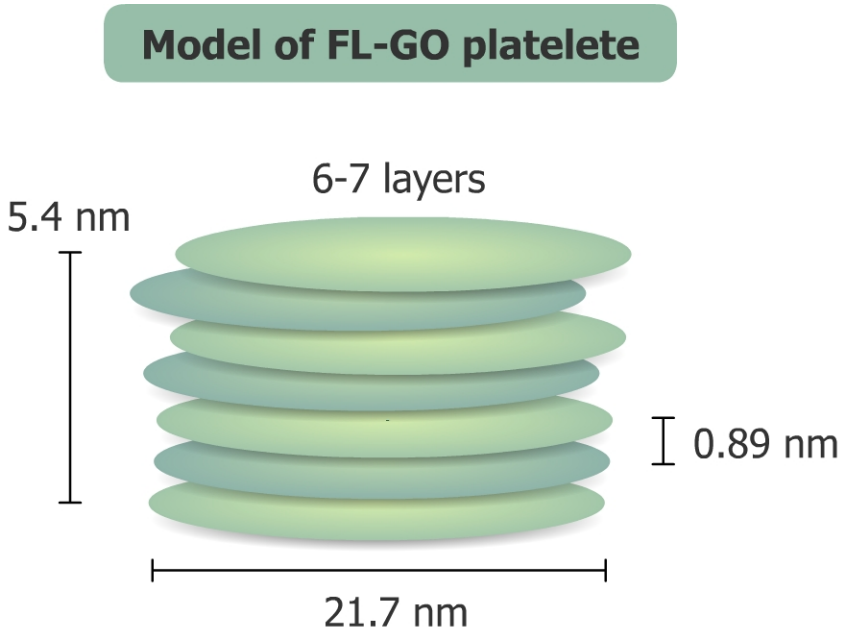
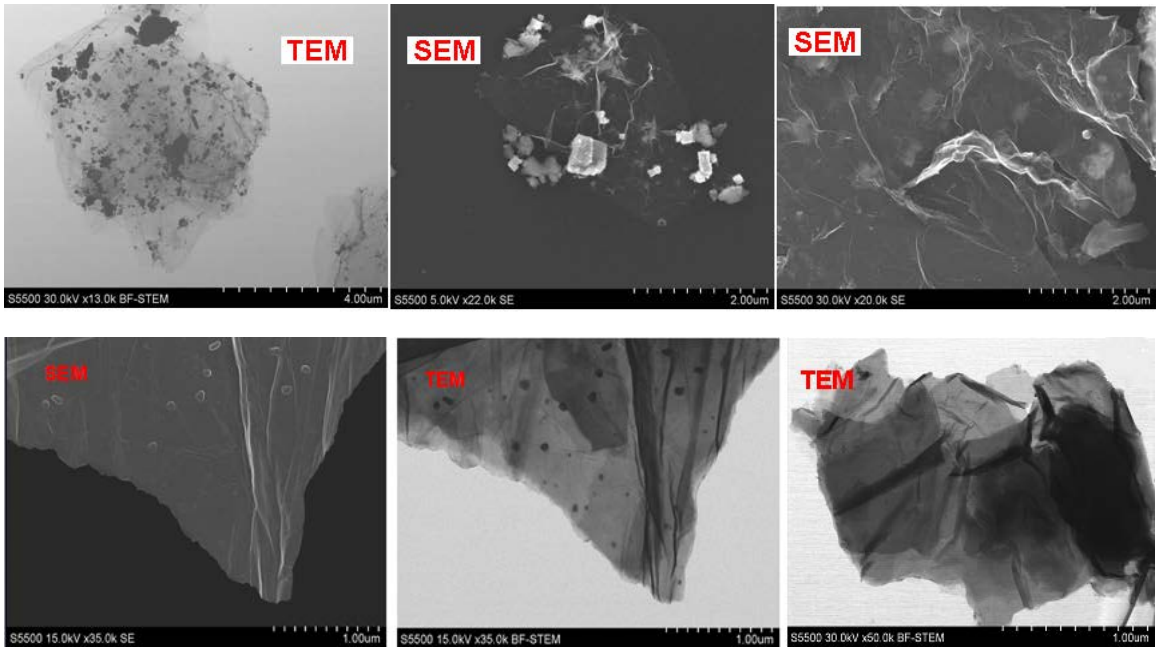
Few Layer Graphene Oxide (FL-GO) platelets (flakes) show stack structure of up to 10 monolayers of oxidized graphene. In contrast to graphene or graphite, carbon atoms therein are bound solely by single chemical σ-bonds and the aromatic system of π-electrons is absent. There are numerous oxygen atoms containing mainly –OH and -COOH moieties. The single FL-GO flake size ranges between several nanometers to micrometers. The distance between particular layers of graphite oxide varies from 0.6 to 0.9 nm. Light to dark yellow-brown FL-GO is highly hydrophilic and forms stable aqueous suspension. It is an organic semiconductor which depending on its degree of oxidation disposes with band gap of 2–3 eV.

Model of FL-GO platelet

The average values are calculated from the XRD patterns. FL-GO reveals stacked nanostructure of 21.7 nm (diameter) x 5.4 nm (height) with a distance of 0.89 nm between 6-7 graphene layers.



STEM of FL-GO



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

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

FL-GO foil:
S(2.5%)>Ca(1%)>Mn(0.5%)>K(0.3%)>Cl(0.08%)=Fe(0.08%)>
Cu(0.2%)=Zn(0.02%)>Ni(0.007%)>Cr(0.006%)

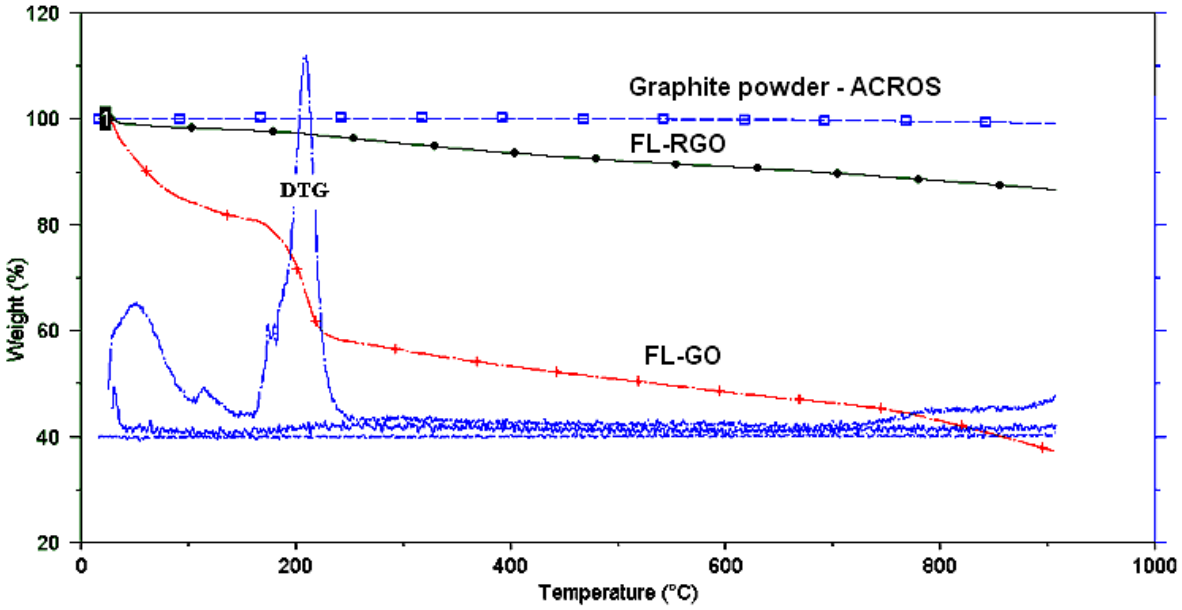
(D. Lisovytskiy et.al., IChF PAN)

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

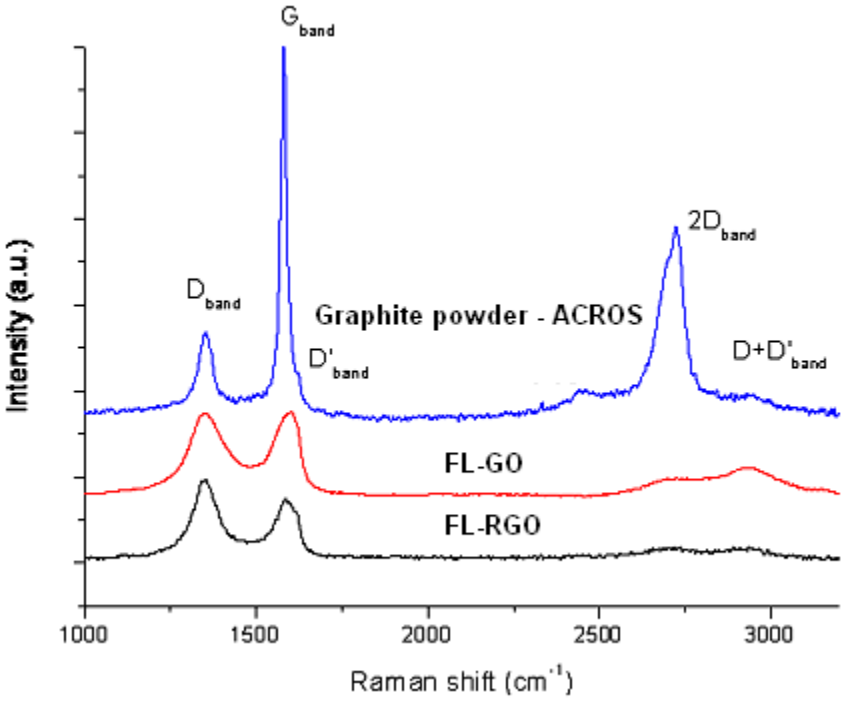
(G. Trykowski et.al., WCh UMK)

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



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

Raman spectroscopy

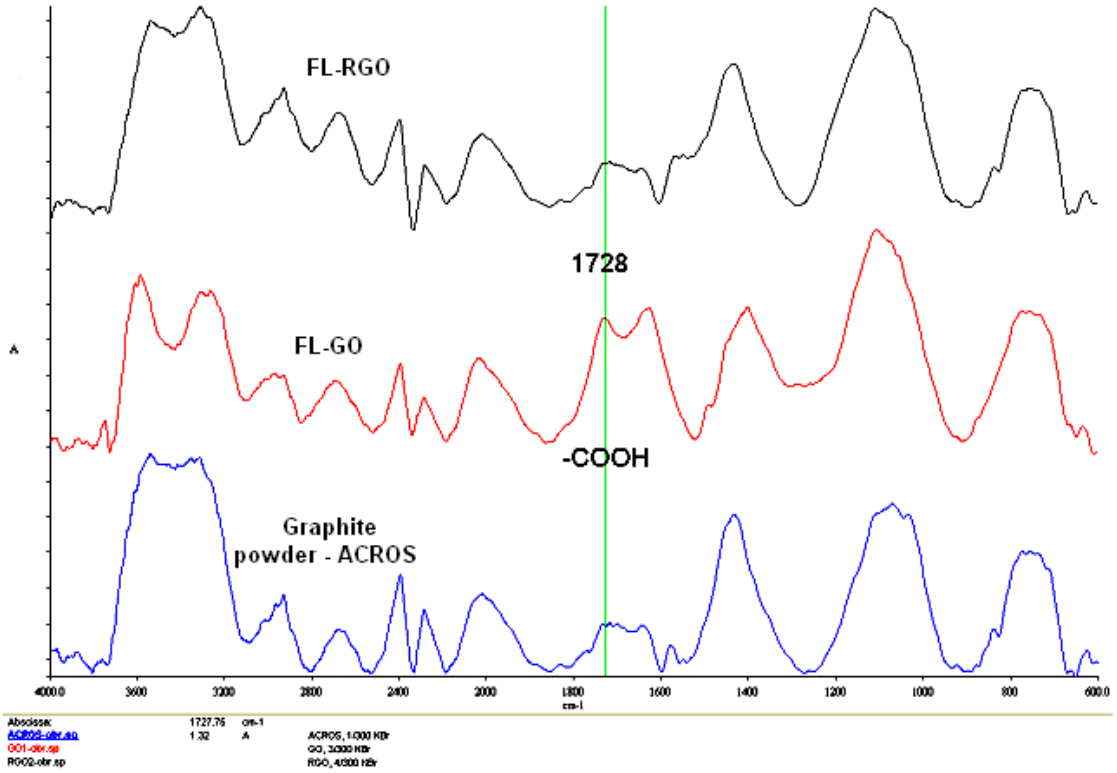


Sample	D position	D FWHM	G position	G FWHM	I_D/I_G	D' position	I_G/I_D	2D position	2D FWHM	I_G/I_{2D}
Graphite ACROS	1352	59	1580	21	0,20	1621	20,56	2686/ 2725	61/ 51	2,61
FL-GO	1353	127	1560	70	1,87	1604	0,69	2701	178	4,61
FL-RGO	1351	83	1582	63	1,48	1612	2,79	2714	199	4,59

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

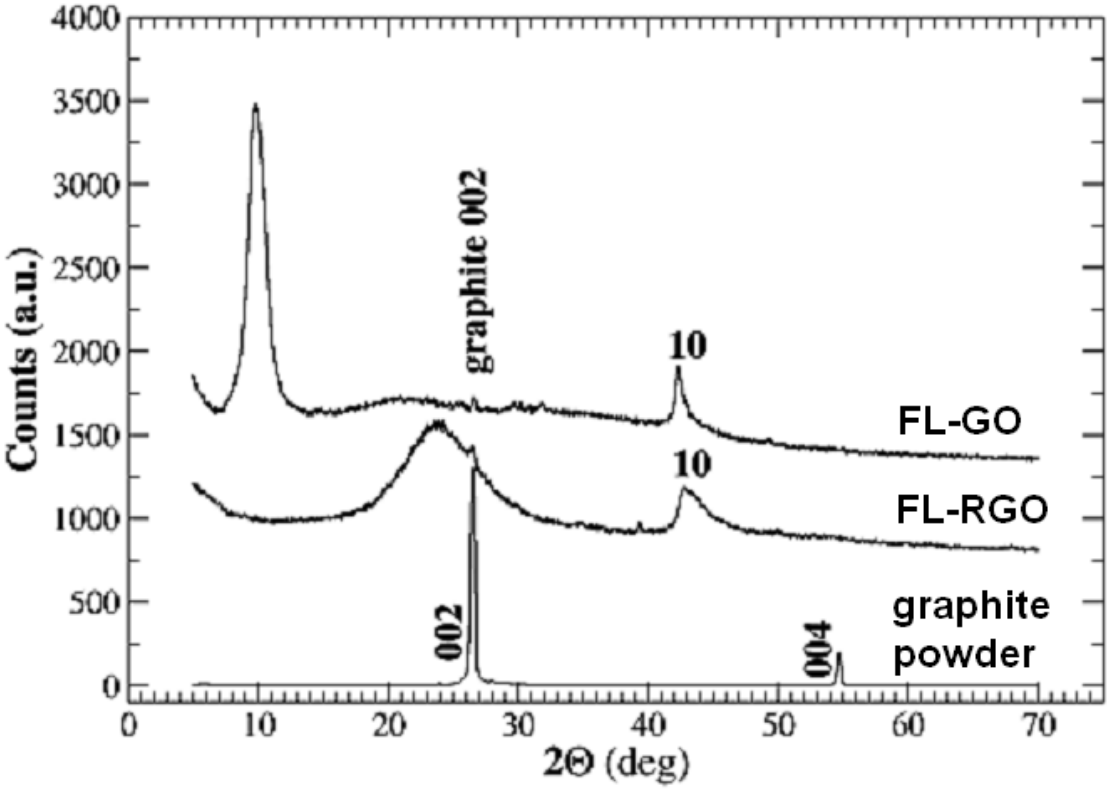
(B. Lesiak-Orlowska et.al., IChF PAN)

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 sp^2 **284.5 eV**	**C** sp^3 **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**
	O 1s group content (at%) – *BE* (eV)					
	H_2**O**		C-**O**H (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**	-

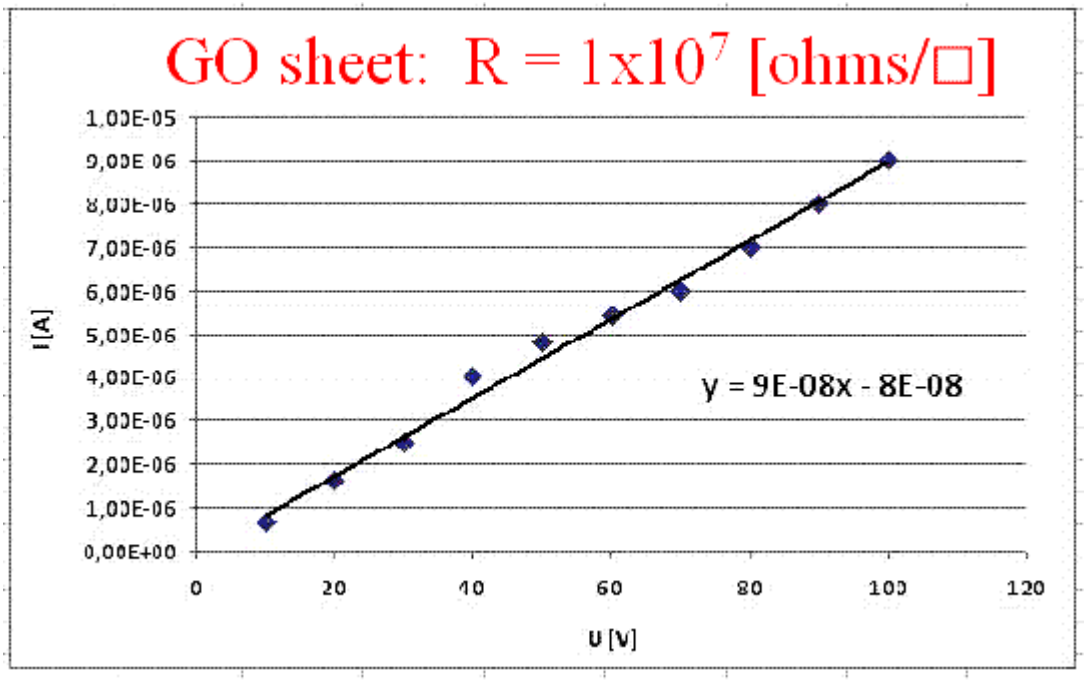
(B. Lesiak-Orlowska et.al., IChF PAN)

XRD analysis



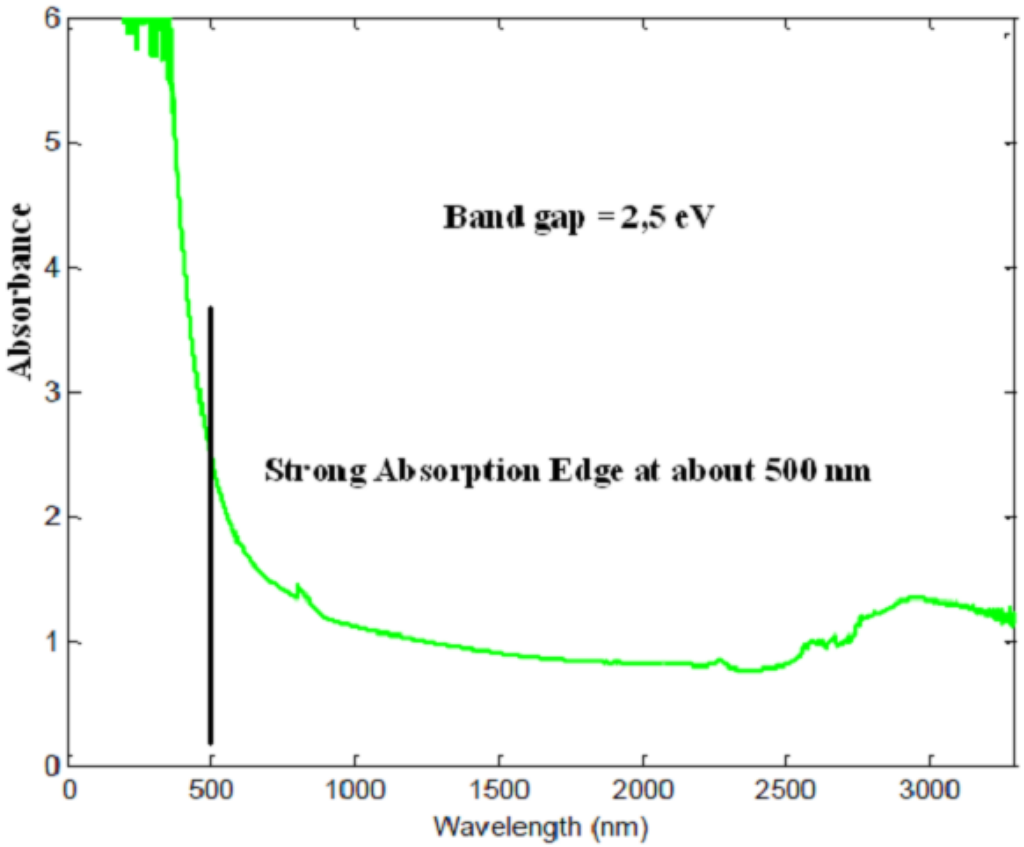
(B. Mierzwa et.al., IChF PAN)

Resistivity of thin layer of FL-GO



(L. Stobinski)

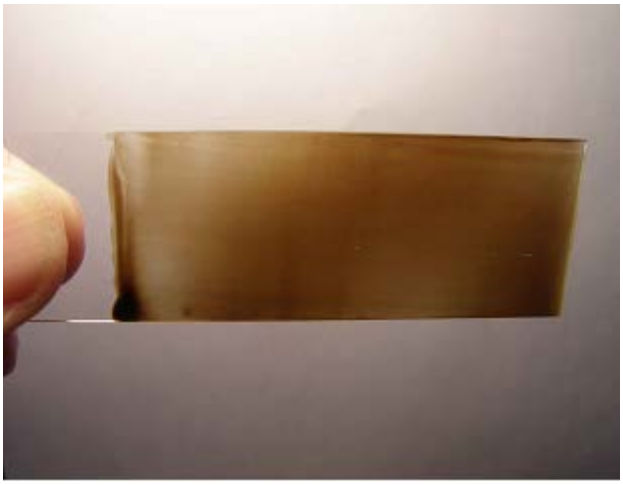
Absorbance measurements



(J. Szczytko et.al., IFD UW)

Thin semiconducting FL-GO layers are suitable for constructing a variety of nanosensors

Thin FL-GO layers on glass plate:



(L. Stobinski)

Glass plate (2x6 cm) covered by the thin graphene oxide layer (thickness around 50-100 nm).