Electronic supplementary information (ESI)

Mesoporous thin films onto graphene FETs: nanofiltrated, amplified and extended field-effect sensing

Sebastián Alberti,[a,‡] Esteban Piccinini,[a,‡,*] Pedro G. Ramirez,[b] Gabriel S. Longo,[a] Marcelo Ceolín,[a] and Omar Azzaroni[a]

[a] Instituto de Investigaciones Fisicoquímicas Teóricas y Aplicadas (INIFTA) – Departamento de Química, Facultad de Ciencias Exactas, Universidad Nacional de La Plata – CONICET, Suc. 4, CC 16, La Plata, Argentina. [*]E-mail: estebanpiccinini@inifta.unlp.edu.ar
[b] Instituto de Matemática Aplicada San Luis (IMASL), UNSL-CONICET, San Luis, Argentina.
[‡]Joint first authors

Table S1

Layer	Material	Model and optical constants	Thickness (nm)
1	Si	Si from CompleteEASE library - $\eta_{632.8\ nm} = 3.874$; $k_{632.8\ nm} = 0.0146$	-
2	SiO_2	SiO_2 from CompleteEASE library - $\eta_{632.8\ nm} = 1.4751$; $k_{632.8\ nm} = 0$	301.8
3	APTES	Cauchy - $\eta_{632.8\ nm} = 1.528$; $k_{632.8\ nm} = 0$; A = 1.504; B = 0.00962; C = 0	1.4
4	rGO	Cauchy - $\eta_{632.8\ nm} = 1.8204$; $k_{632.8\ nm} = 0$; A = 1.808; B = 0.0048; C = 0	0.7
5	Mesoporous thin film at 4000 rpm	EMA Bruggeman with VOID and SiO_2 - $\eta_{632.8\ nm} = 1.205$; $k_{632.8\ nm} = 0$; 53.4% SiO_2	135
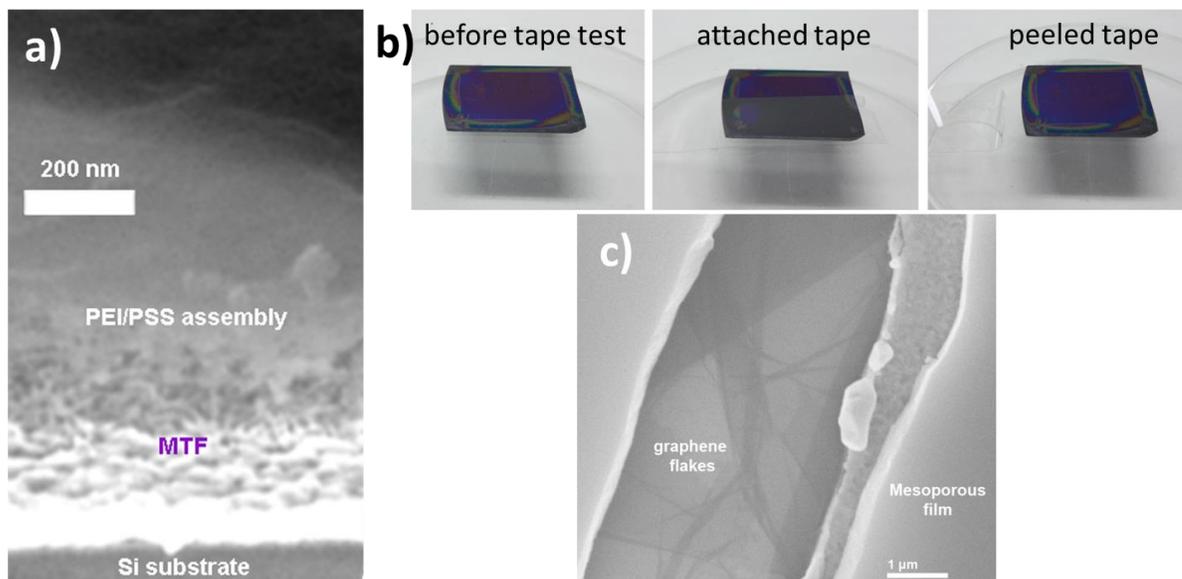
Fig S1. (a) Side view SEM image of a MTF after the LbL deposition of four polyelectrolyte PEI/PSS layers (b) Adhesion test using a scotch-tape for MTF prepared onto a rGO-modified Si substrate. (c) Scanning electron micrograph of GFET modified with MTF made of non-optimized precursor formulation. It can be seen MTF fissures exposing the rGO flakes below the MTF.
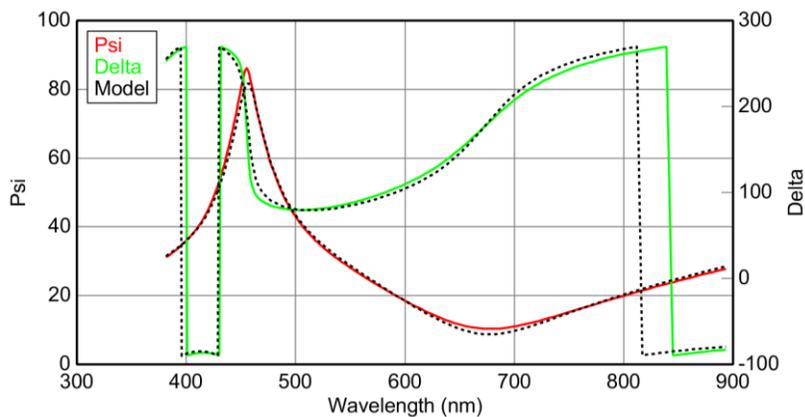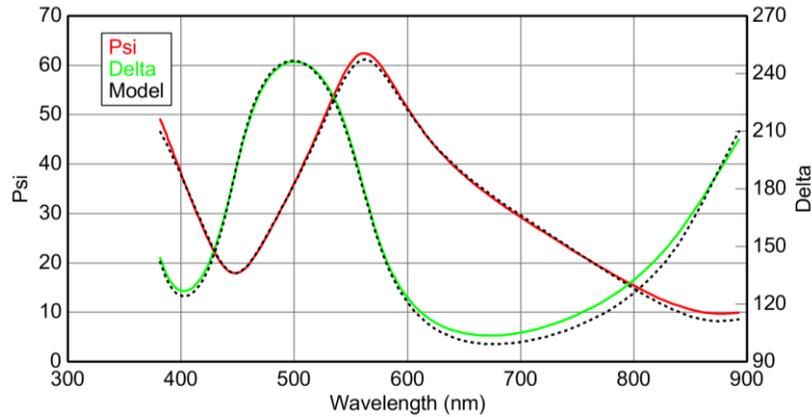
Figure S2. Spectroscopic ellipsometric measurements (solid lines) and model fits (dashed lines) for Si wafer substrate modified with rGO (top plot) and silica MTF prepared at 4000 rpm onto rGO-modified Si wafer substrates (bottom plot).
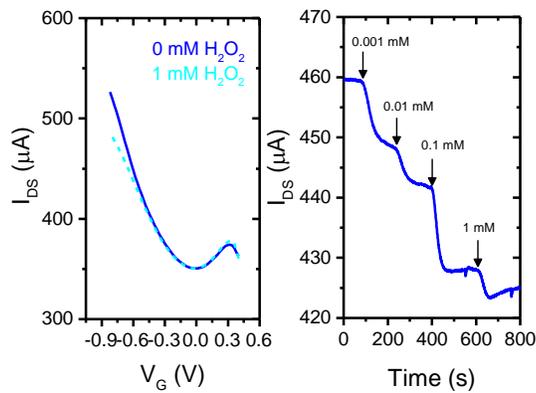
Fig S3. Left: I_{DS}-V_G curves of MTF-GETs in the absence (blue) and the presence (light blue) of 1 mM H_2O_2. Right: Real-time measurements of H_2O_2 detection for a MTF-GFET by using a flow-cell. H_2O_2 concentrations values range from 0 to 1 mM. The arrows indicate the change of the solution to be eluted (V_G = -400 mV). All the experiments were carried out using an Ag/AgCl gate, 10 mM KCl and applying V_{DS} = 100 mV.
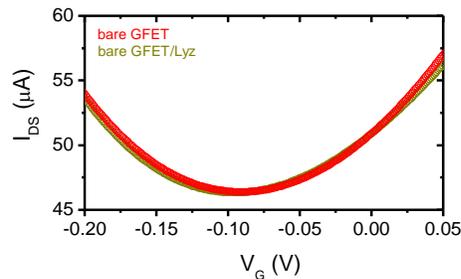
Fig S4. I_{DS}-V_G curves for GFET sensors without a MTF. The I_{DS}-V_G curves show the response before (red) and after (brown) lysozyme adsorption. The experiments were carried out using an Ag/AgCl gate, AcH/AcNa-NaCl buffer (pH = 5, ionic strength = 140 mM) and applying V_{DS} = 100 mV.
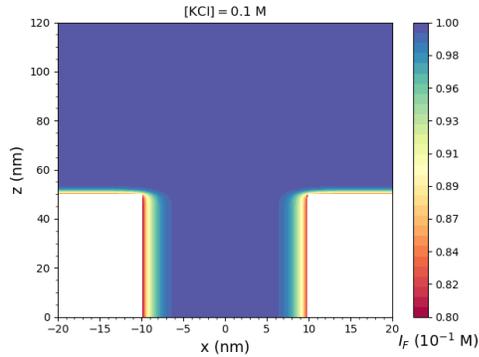
Figure S5. Plots of the ionic strength as a function of position (r, z) at 100 mM KCl and pH 7, as predicted by the thermodynamic model.
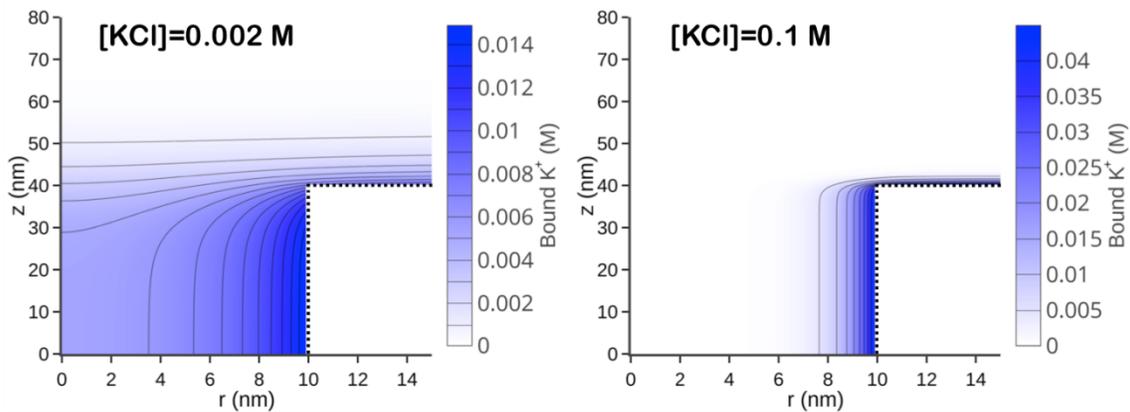
Figure S6. Plots of the concentration of bound potassium as a function of position (r,z) at different bulk salt concentrations and pH 7. The black dotted lines denote the charged interface between the silica (white region) and aqueous solution. These concentrations are defined as the local excess with respect to the concentration of chloride ions.