Supplementary Information

A comparative study of ZnO growth on Graphene and Graphene Oxide: the role of the initial oxidation state of carbon

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This appendix shows supplementary data that complement the descriptions and explanations of the Results section. Each Figure is self-explained by its corresponding caption.

Figure S1

In order to achieve low amount of ZnO deposits, three different positions of the substrate with respect to the evaporator were used. This methodology, in which the deposition rate varies while the evaporation rate remains constant, appeared to be the best to obtain samples with very low coverages. The evaporation for each position was finished once the intensity of the Zn 2p (in situ XPS) was saturated.

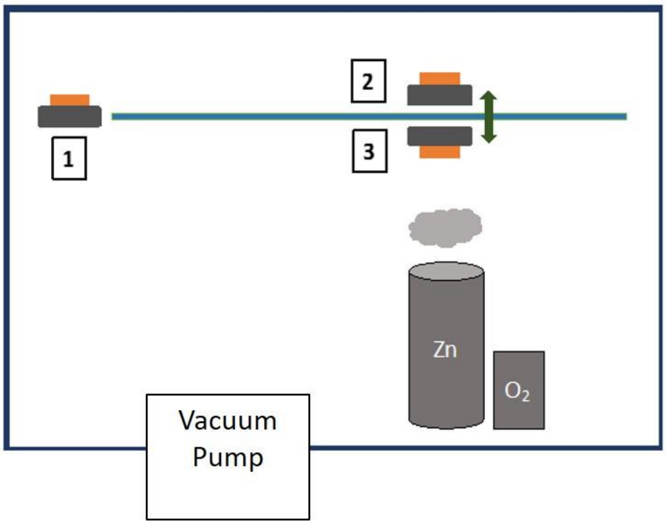


Figure S1. Schematic drawing of the substrate position with respect the evaporator.

These three positions are shown in Figure S1: 1) hidden about 30 cm from the evaporator edge; 2) normal and facing back the evaporator; 3) normal and facing the evaporator.

Figure S2

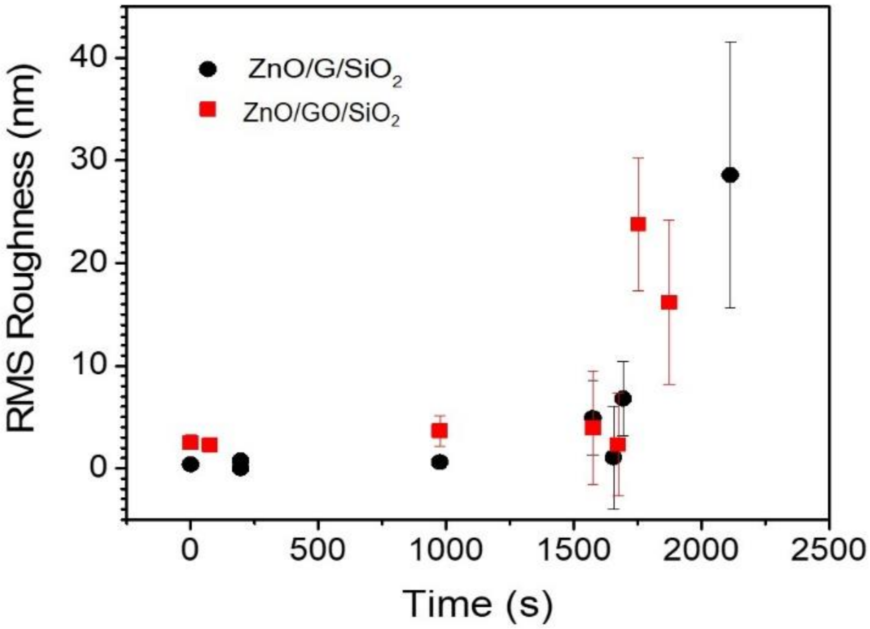
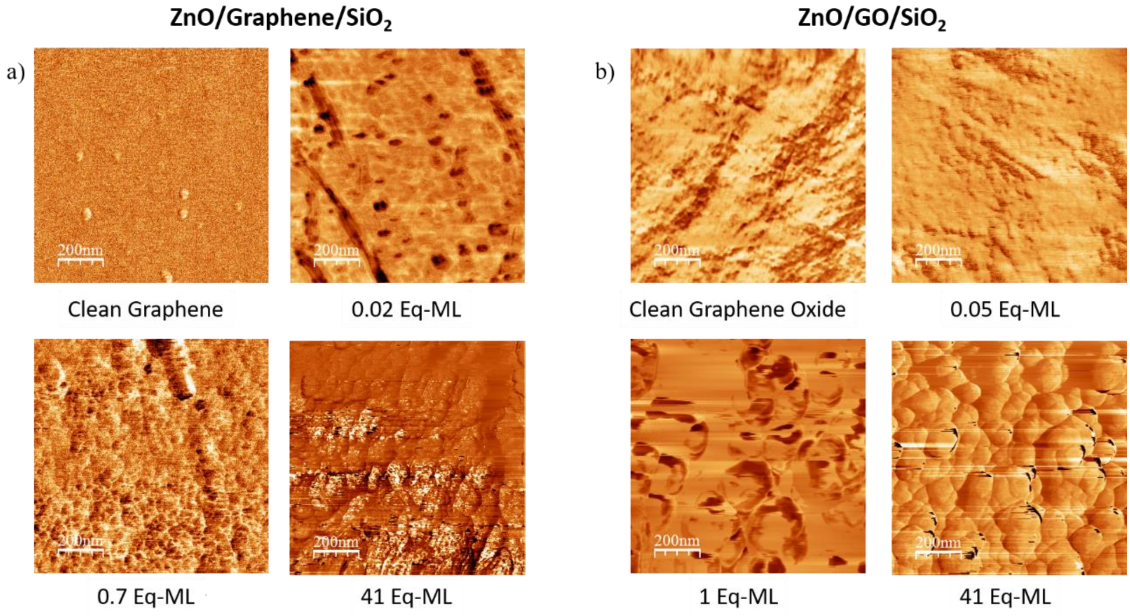


Figure S2. RMS roughness as a function of evaporation time for G/SiO2 (black circles) and GO (red square) substrates.

Figure S3


ZnO/Graphene/SiO_2

ZnO/GO/SiO_2

a)

Clean Graphene

0.02 Eq-ML

0.7 Eq-ML

41 Eq-ML

b)

Clean Graphene Oxide

0.05 Eq-ML

1 Eq-ML

41 Eq-ML

Figure S3: AFM images of the excitation frequency channel corresponding to the topographic images shown in Figure 3. a) ZnO growth on Graphene/SiO_2: for the bare substrate, the contrast is localized at small contamination grains, also observed in the topography. The initial stage of growth, as depicted by the contrast in the second image, is localized at the surface features (graphene wrinkles). The image for 0.7 equivalent monolayers (Eq-ML), shows contrast at the ZnO grains all over the surface. Finally, with 41 Eq-ML the contrast is reduced, as the surface is completely covered. b) ZnO growth on GO/SiO_2: the bare oxide substrate already shows contrast in this channel. Similarly to the graphene case, at 1 Eq-ML the contrast is maximum, showing the different nature of the ZnO clusters. For the last image, with the surface covered with ZnO, the contrast is reduced, only the apex of the clusters has a remarkable contrast, the rest can be attributed to the effect of the topographic slope.

Figure S4

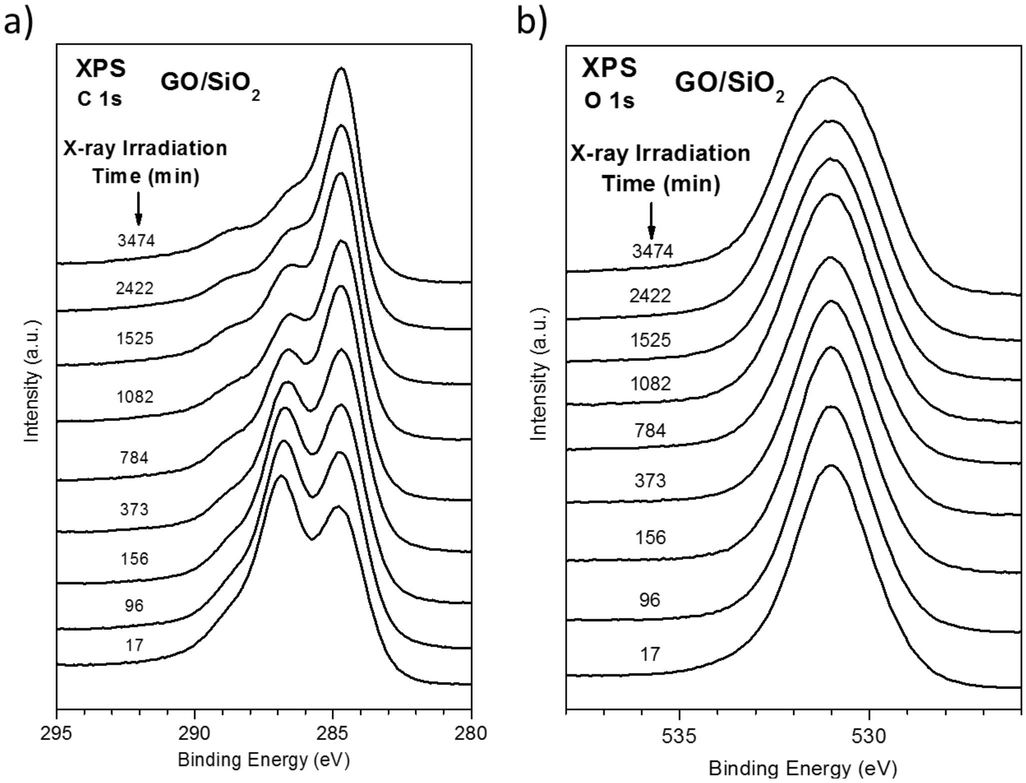


Figure S4. XPS C 1s and O 1s spectra of GO as a function of irradiation time.

Figure S5

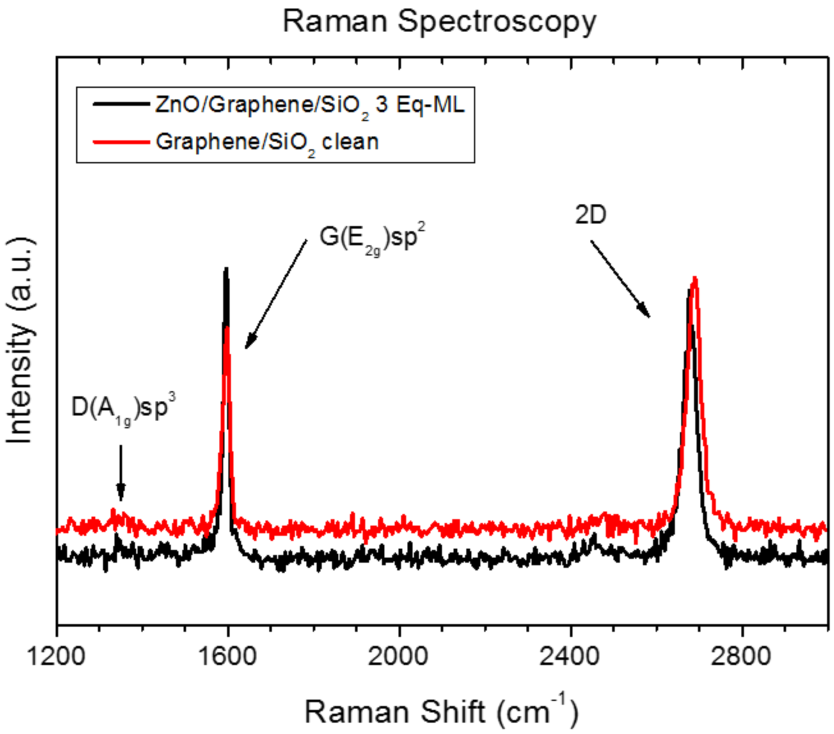


Figure S5. Raman spectra of a clean G/SiO$_2$ substrate (red line) and after deposition of 3 Eq-ML, ZnO/G/SiO$_2$ (black line).

Figure S6

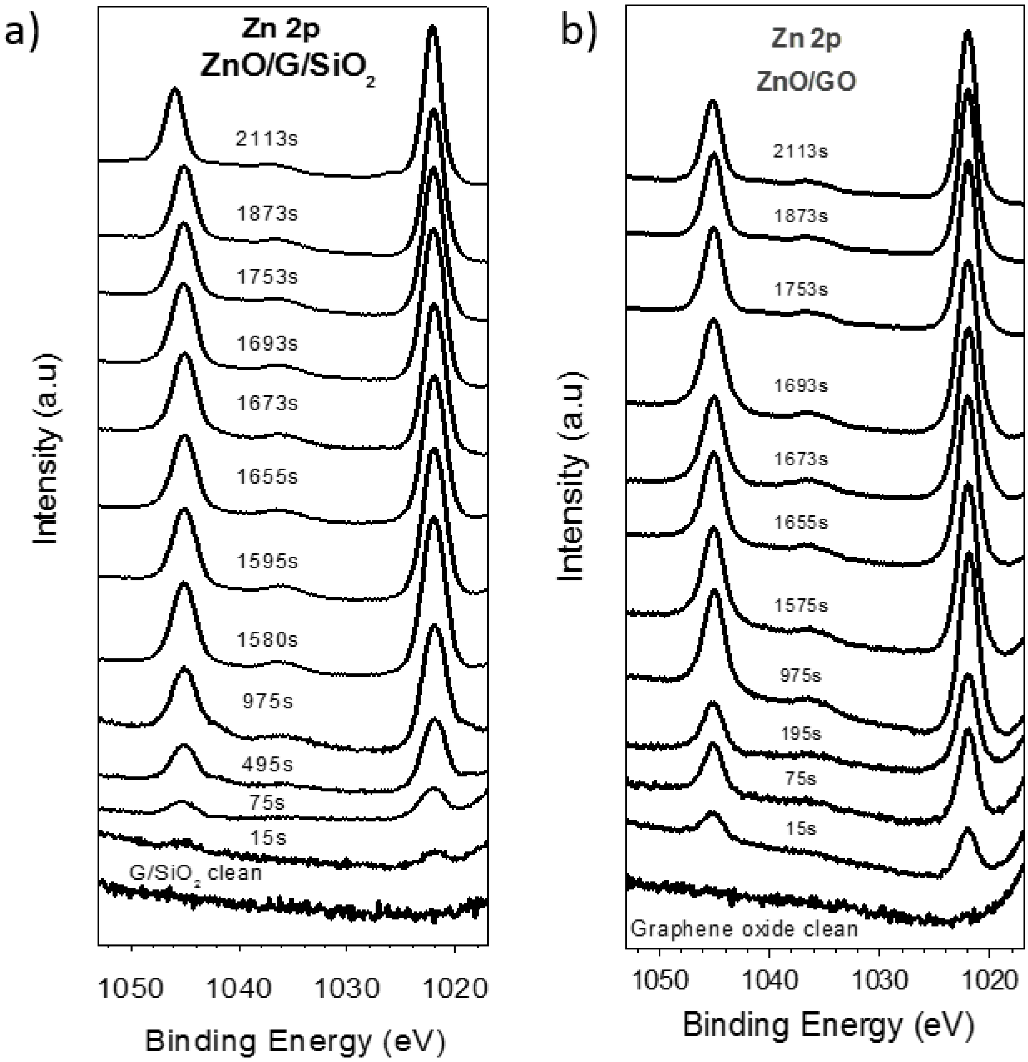


Figure S6. XPS Zn 2p spectra as a function of the evaporation time for the growth of ZnO on a) G/SiO$_2$ and b) GO.