

Supplementary Information

Biocide mechanism of highly efficient and stable antimicrobial surfaces based on zinc oxide-reduced graphene oxide photocatalytic coatings

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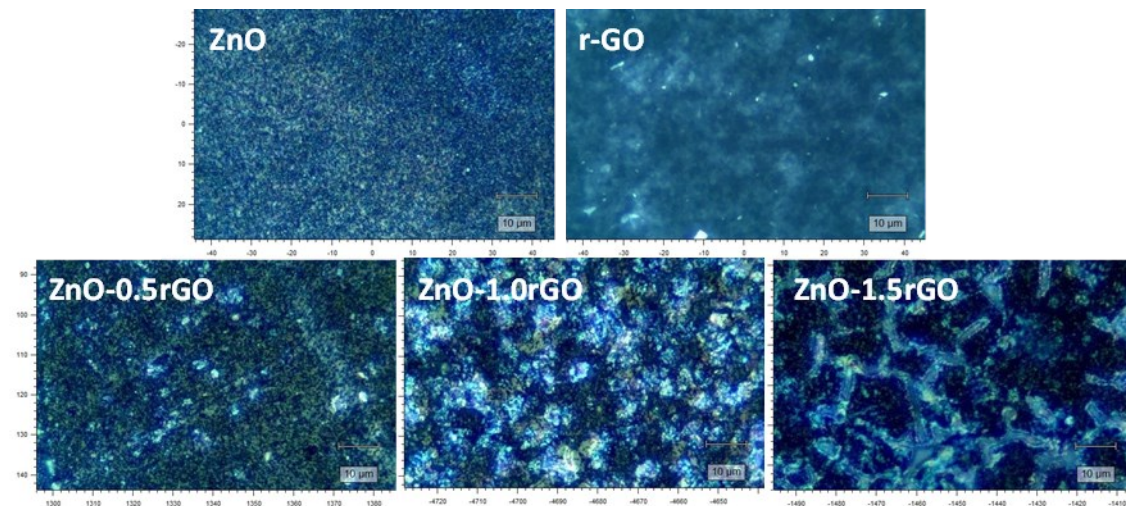


Figure S1. Optical microscope images (100x magnification) of ZnO, ZnO-rGO and rGO functionalised surfaces.

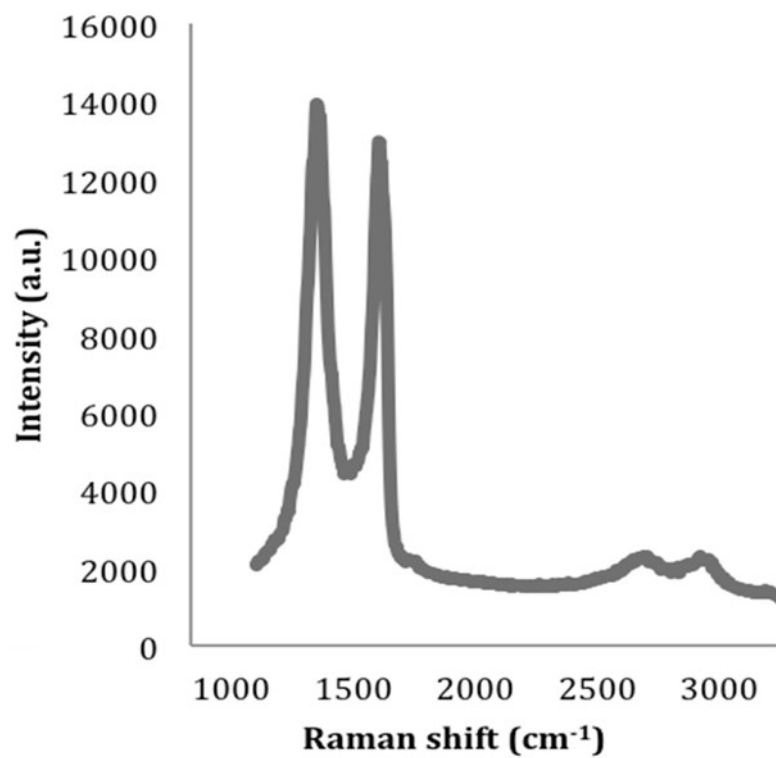


Figure S2. Raman spectrum of commercial GO (Graphenea, Spain).

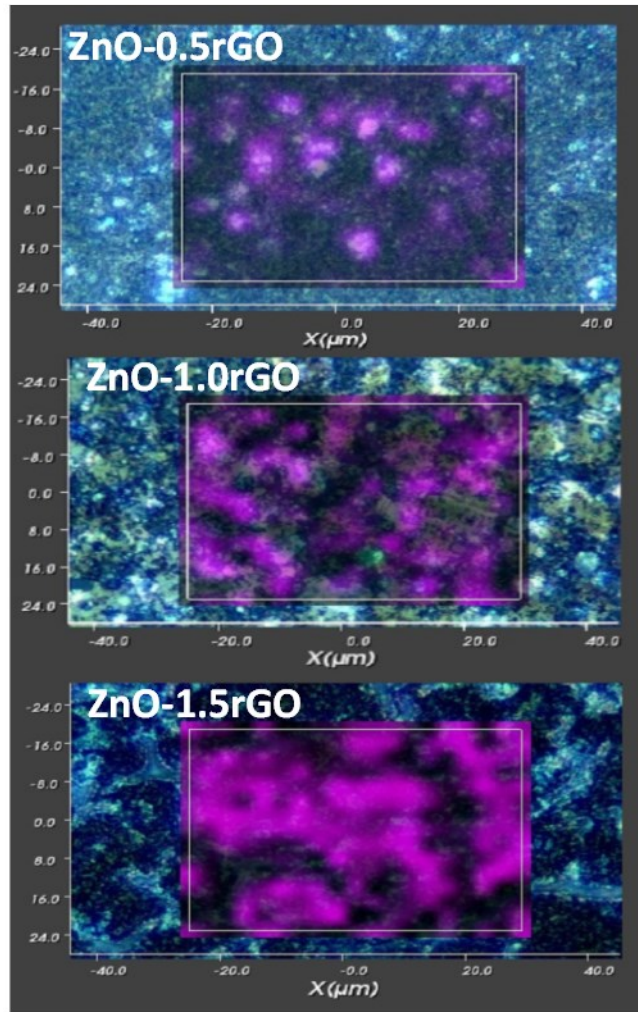


Figure S3. Intensity colour maps of the Raman band at 1375 cm⁻¹ corresponding to the rGO phase in the ZnO-rGO functionalised surfaces.

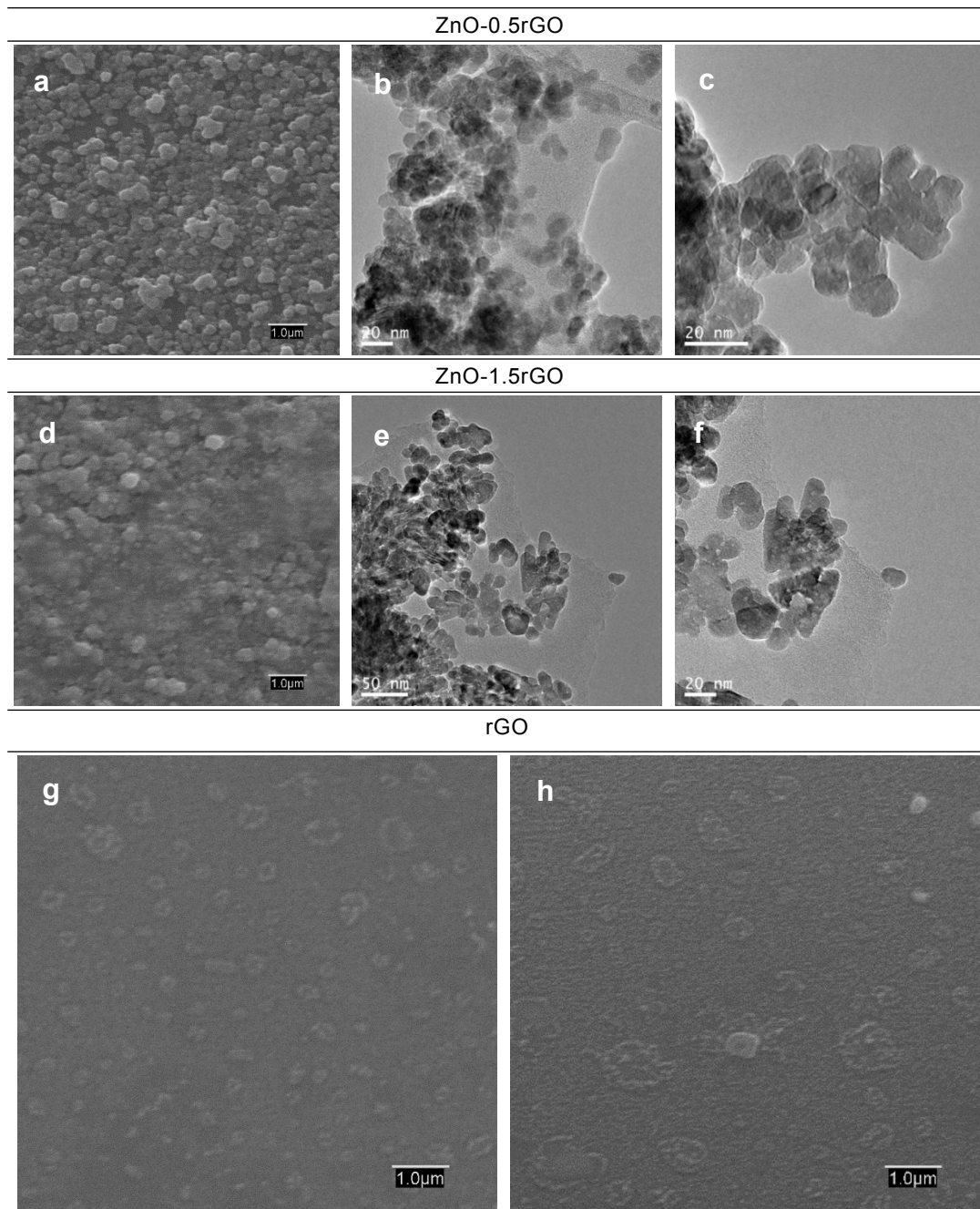


Figure S4. SEM (a, d, g, h) and TEM (b, c, e, f) images of the ZnO-0.5rGO, ZnO-1.5rGO and rGO functionalised surfaces.

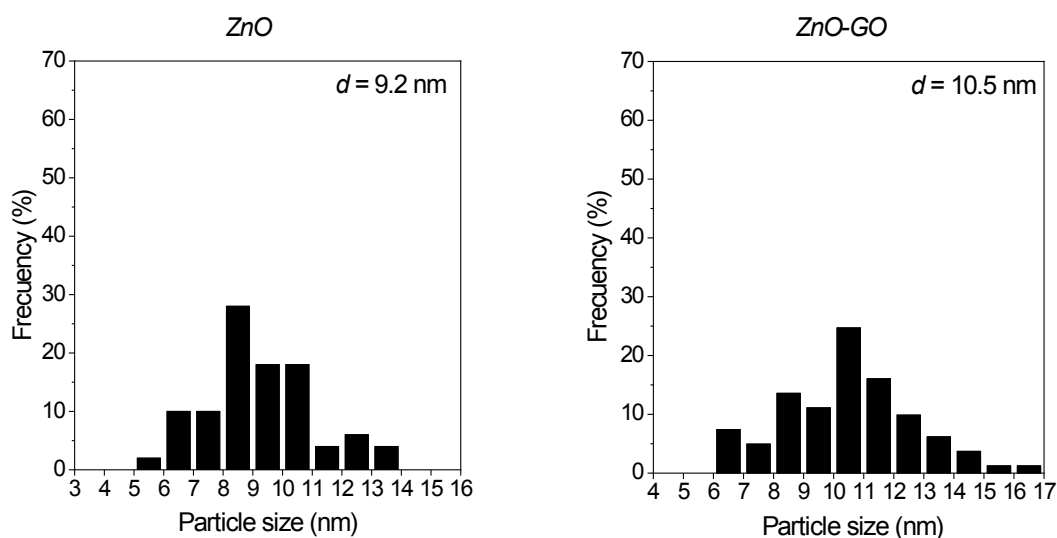


Figure S5. Particle size distribution obtained from TEM images for ZnO and ZnO-1%rGO functionalised surfaces.

Table S1. Colony-forming units (\log CFU cm^{-2}) of *S. aureus* measured from the surface after bacteria-containing aerosol spraying on non-functionalized (control) and ZnO, ZnO-rGO and rGO functionalised surfaces.

	No irradiation L(-)	Winter irradiation L(+)	Summer irradiation L(++)
Control	6.81 \pm 0.30	6.43 \pm 0.34	5.62 \pm 0.31
ZnO	4.20 \pm 0.62	3.18 \pm 0.07	2.97 \pm 0.43
ZnO-0.5rGO	4.55 \pm 0.23	3.91 \pm 0.53	2.77 \pm 0.54
ZnO-1.0rGO	4.15 \pm 0.52	3.24 \pm 0.45	1.88 \pm 0.45
ZnO-1.5rGO	4.45 \pm 0.50	4.15 \pm 0.46	3.20 \pm 0.21
rGO	6.97 \pm 0.55	7.02 \pm 0.33	6.08 \pm 0.31

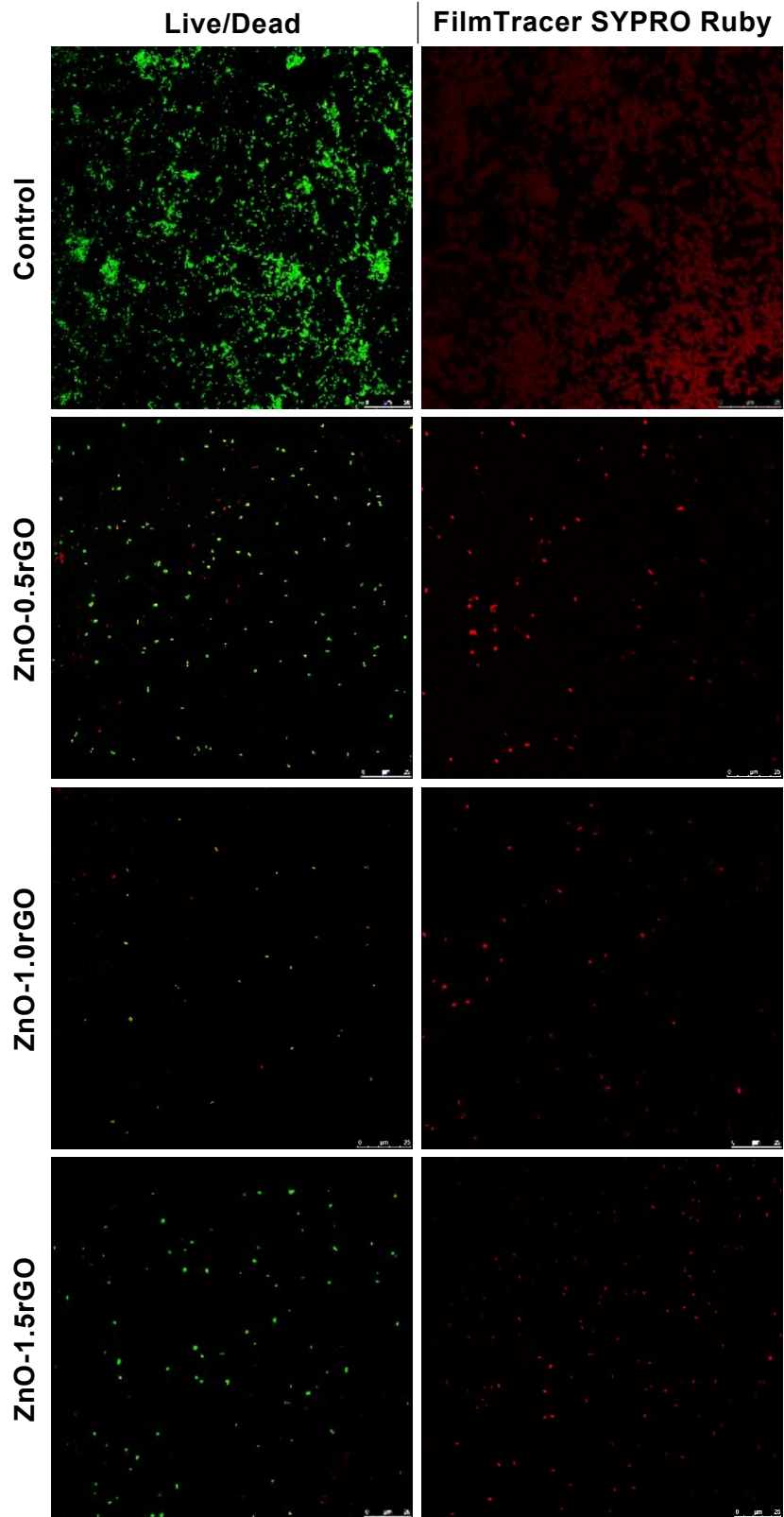


Figure S6. Live/Dead and FilmTracer SYPRO Ruby Biofilm Matrix Stain of *S. aureus* on non-functionalised (control) and ZnO-rGO functionalised surfaces upon Winter-Fall irradiation, L(+).

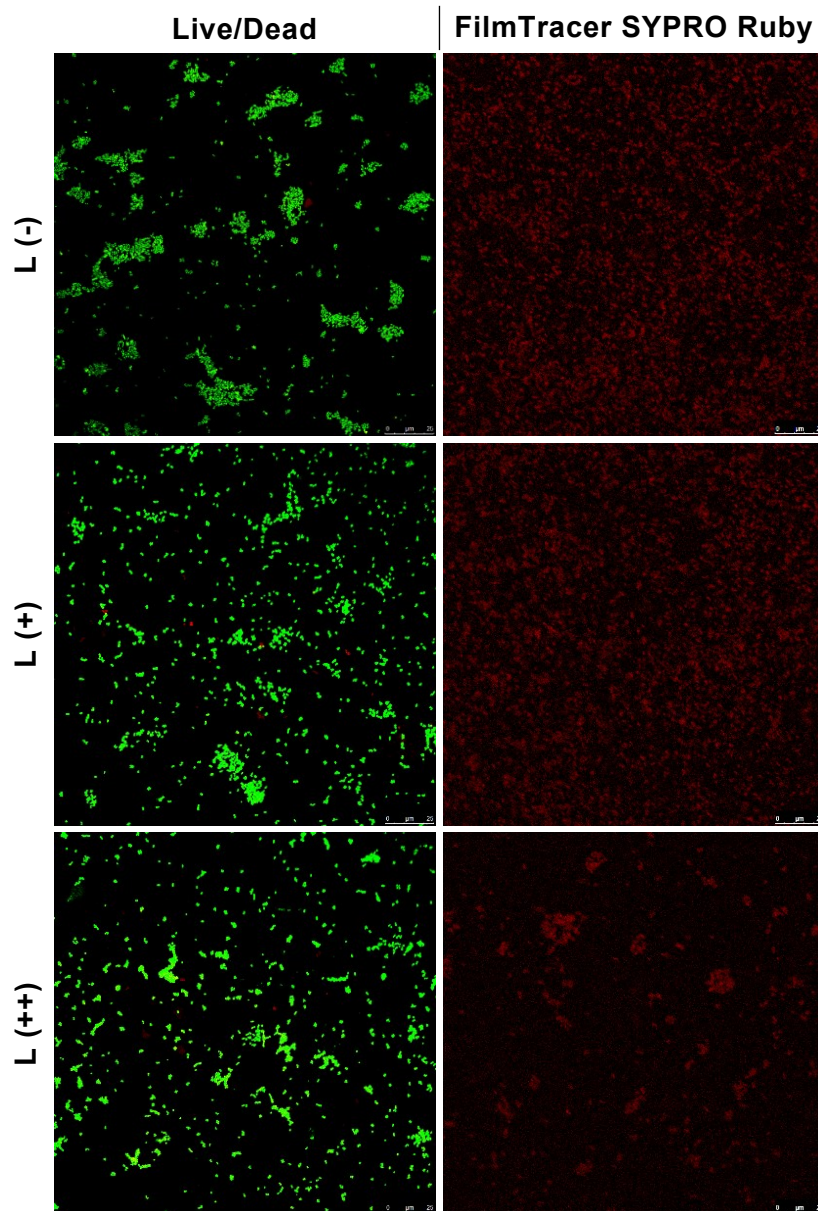


Figure S7. Live/Dead and FilmTracer SYPRO Ruby Biofilm Matrix Stain of *S. aureus* on rGO functionalised surfaces in the absence of irradiation, L(-), upon Winter-Fall irradiation, L(+), and upon Summer-Spring irradiation, L(++).

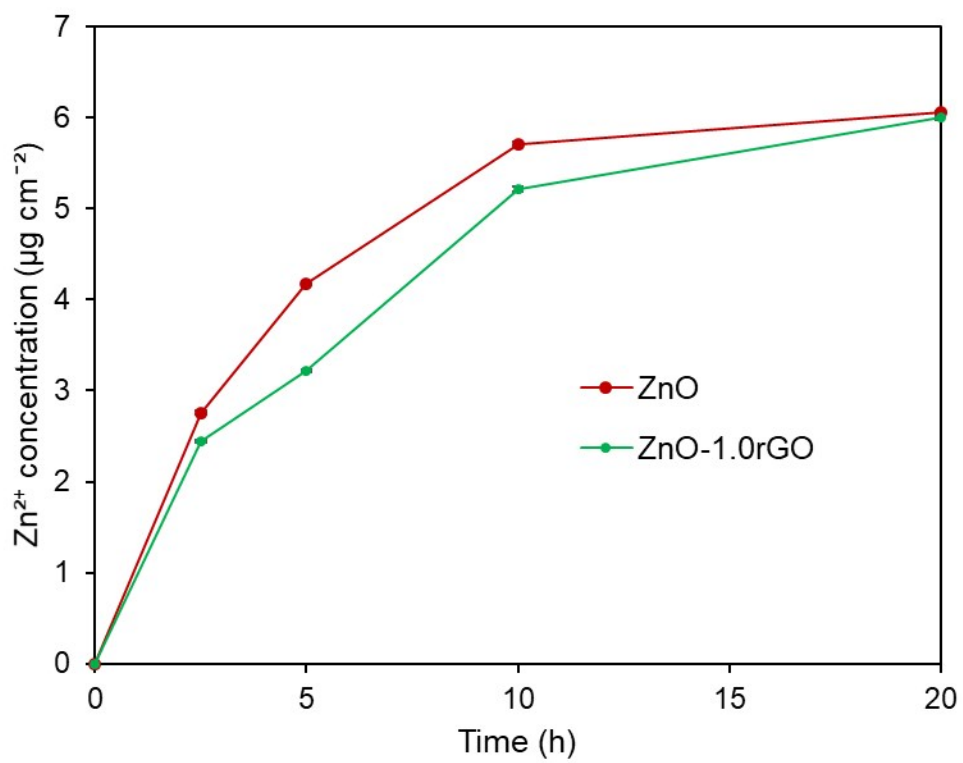


Figure S8. Solubility of zinc ions (Zn^{2+}) from ZnO and ZnO-1.0rGO functionalized surfaces in Milli-Q water at 37°C over time.

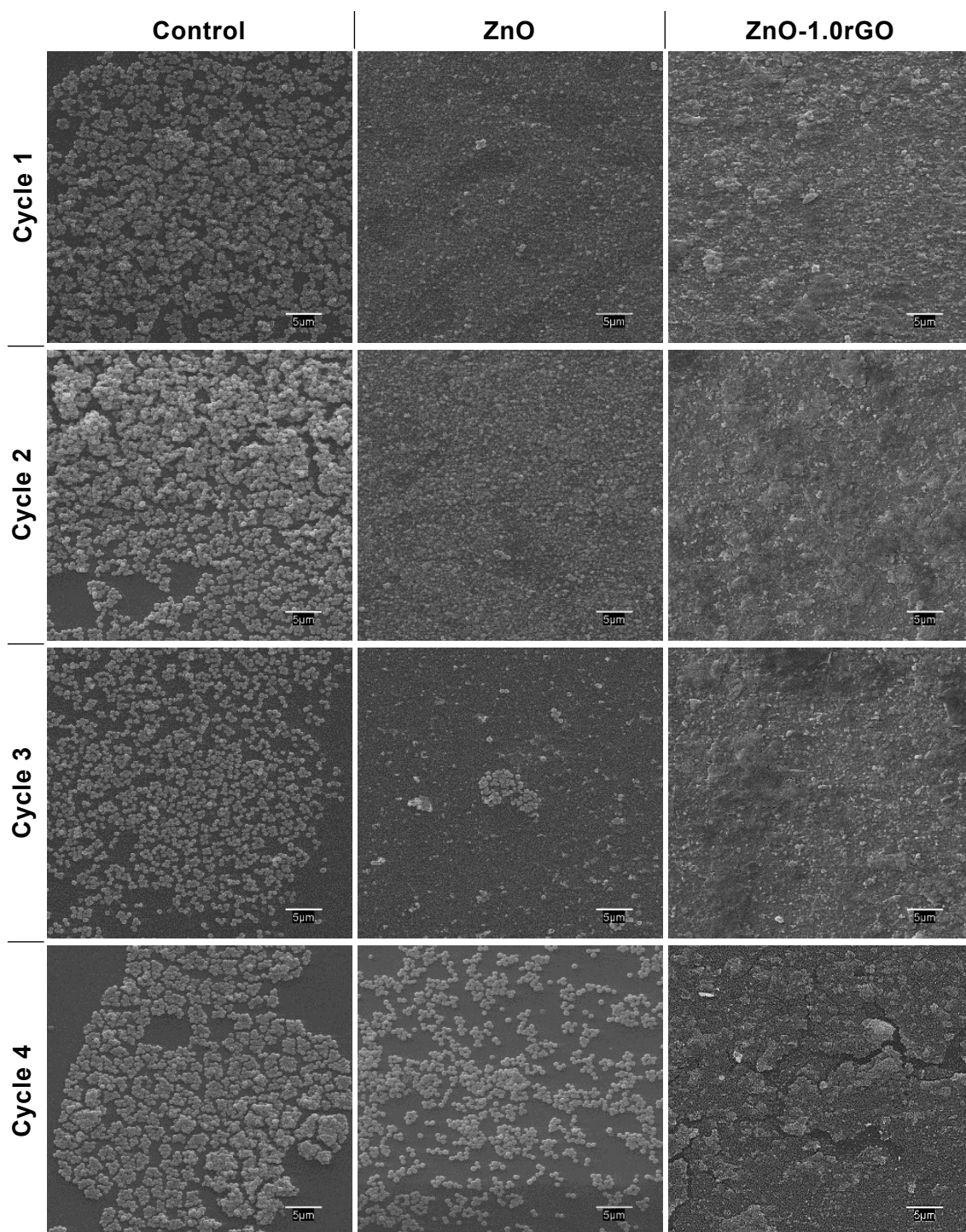


Figure S9. SEM images of *S. aureus* on non-functionalised surfaces and ZnO and ZnO-1.0rGO functionalised surfaces upon Summer-Spring, L(++), irradiation for four consecutive cycles.

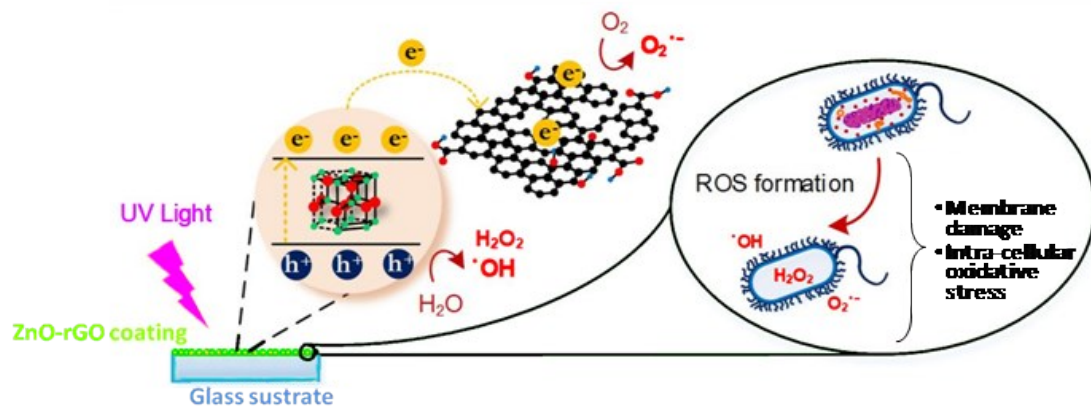


Figure S10. Schematic representation of the antibacterial action mechanism.