Radiation induced reduction of Graphene Oxide: a dose effect study

Souad Abou Zeid, [a] Selma Bencherif,[b] Rasta Ghasemi,[c] Rituporn Gogoi,[a,d] Yamina Chouli,[a] Matthieu Gervais,[e] Diana Dragoe,[f]

[a.] *Institut de Chimie Physique, ICP, UMR 8000, CNRS, Université Paris-Saclay, bâtiment 349, Campus d'Orsay, 15 avenue Jean Perrin, 91405 Orsay Cedex, France.*
[b.] *Université de Paris, ITODYS, CNRS, UMR 7086, 15 rue J-A de Baïf, F-75013, Paris, France*
[c.] *Institut d'Alembert, IDA, ENS Paris-Saclay, 4 avenue des sciences, 91190 Gif-sur-Yvette, France.*
[d.] *School of Chemical Sciences, Indian Institute of Technology Mandi, Mandi, Himachal Pradesh-175005, India.*
[e.] *Laboratoire Procédés et Ingénierie en Mécanique et Matériaux, PIMM, Arts et Métiers ParisTech, UMR 8006, CNRS, CNAM, HESAM université, 151 boulevard de l'hôpital, 75013 Paris, France.*
[f.] *Institut de Chimie Moléculaire et des Matériaux d'Orsay, ICMMO, UMR 8182, CNRS, Université Paris-Saclay, bâtiment 410, Campus d'Orsay, Rue du doyen Georges Poitou, 91405, Orsay Cedex, France.*
[g.] *Département Chimie Vivant Santé, EPN 7, Conservatoire National des Arts et Métiers, CNAM, 292 rue Saint-Martin, 75141 Paris Cedex 03, France.*
[*] *Corresponding author. Institut de Chimie Physique, ICP, UMR 8000, CNRS, Université Paris-Saclay, bâtiment 349, Campus d'Orsay, 15 avenue Jean Perrin,91405 Orsay Cedex, France. E-mail address: samy.remita@universite-paris-saclay.fr (Samy Remita).*

Jalal Ghilane,[b] Prem Felix Siril [d] and Samy Remita *[a,g]

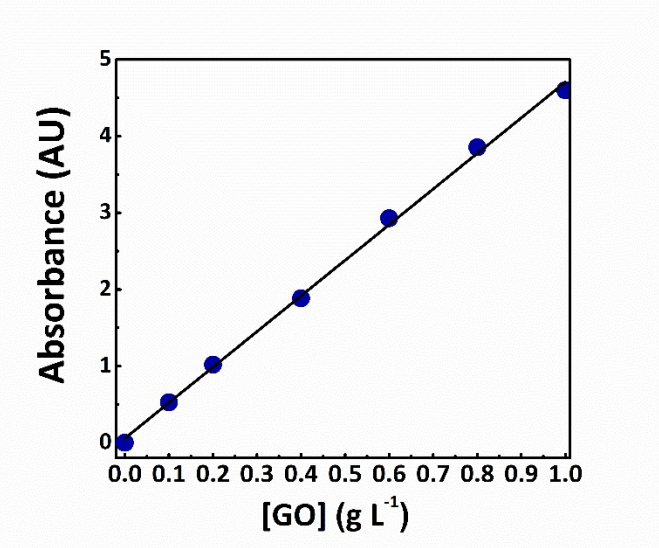

Figure S1. The plot of the absorbance (λ = 295nm) divided by the cell length (L=0.2 cm), versus the concentration of GO (from 0.1g L^{-1} to 1 g L^{-1}). The Beer-Lambert law (A = ε × C × l), allowed the determination of the absorption coefficient (ε). This linear relationship fits well with Beer-Lambert's Law, indicating that commercial GO used in our study possesses good water solubility.

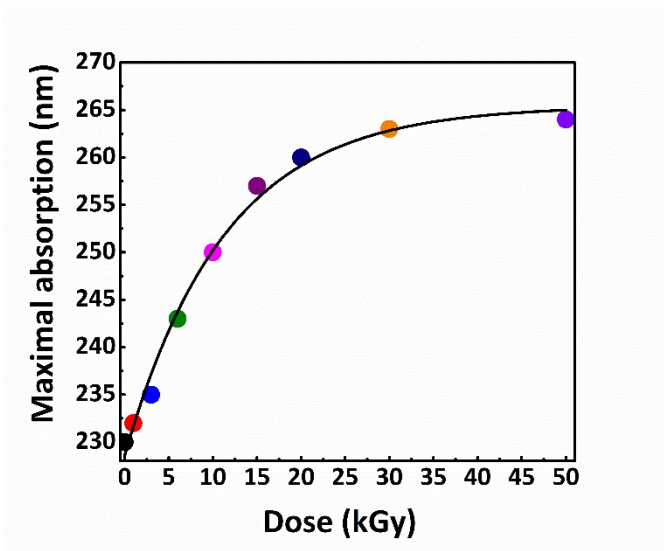

Figure S2. Exponential curve fitting representing the increase in sp^2 hybridization absorption with the absorbed dose (in presence of 0.2 M tert-butanol). The intersection between the tangent line at the beginning of the exponential curve and the asymptote at the maximal absorption provides the necessary dose required to reduce the GO.

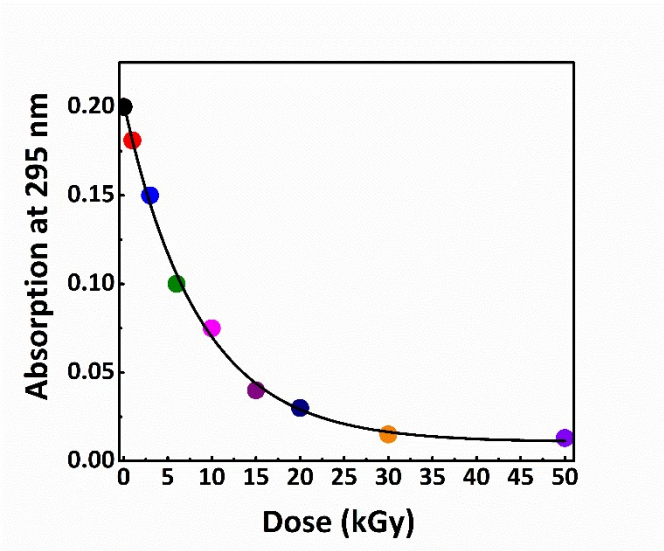

Figure S3. Exponential curve fitting of the decrease with absorbed dose of the absorption of C=O bands in presence of 0.2 mol L^{-1} tert-butanol. The intercept on the x-axis of the tangent in origin to the exponential curve fitting gives the value of the necessary dose for rGO synthesis, and the slope of this tangent gives the value of the radiolytic yield (G-value) that was found 1.9×10^{-5} g J^{-1}.

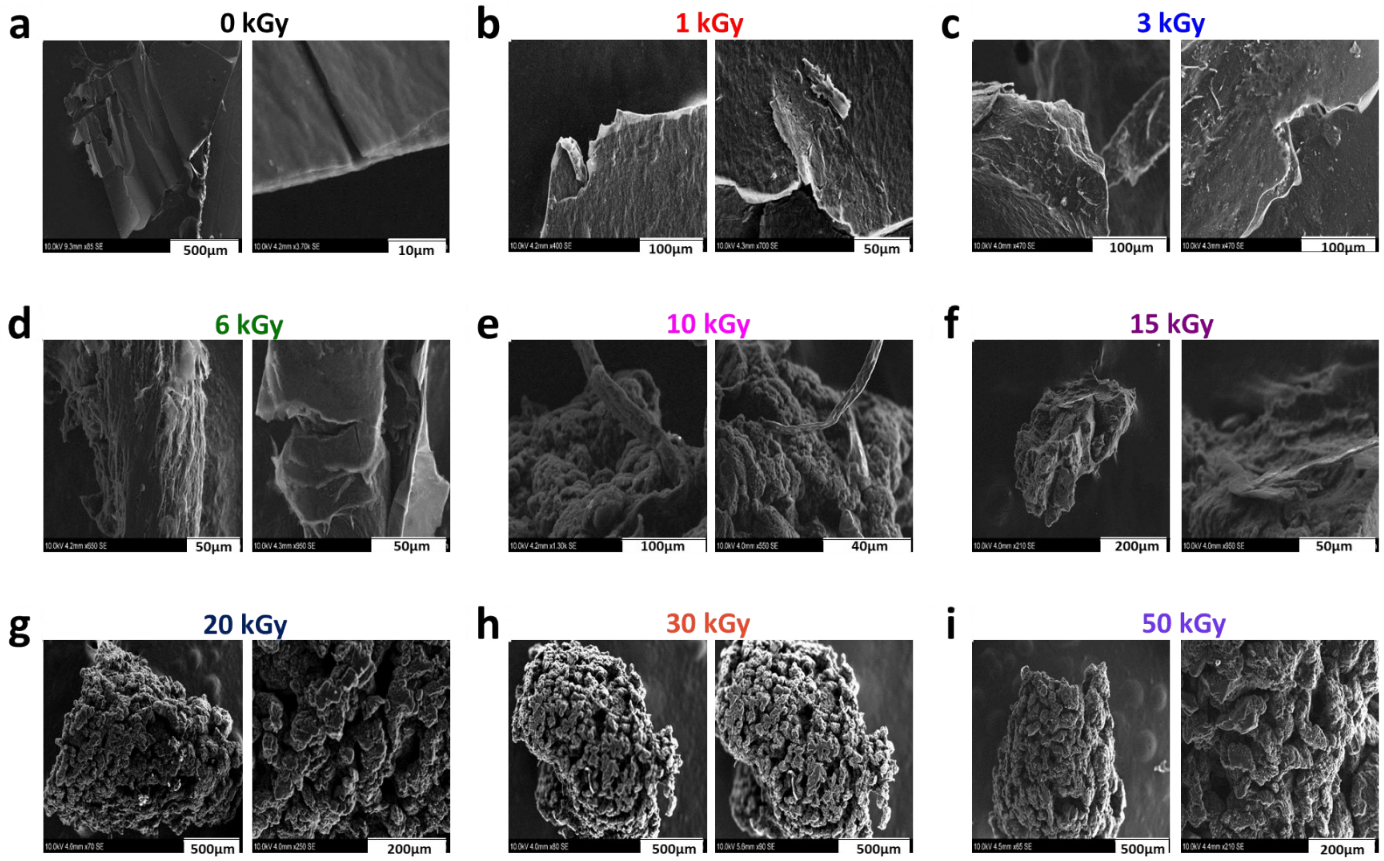

Figure S4. SEM images at different magnifications of **(a)** commercial GO (0.2 g L^{-1}), **(b)** rGO-1 kGy, **(c).** rGO-3 kGy, **(d)** rGO-6 kGy, **(e)** rGO-10 kGy, **(f)** rGO-15 kGy, **(g)** rGO-20 kGy, **(h)** rGO-30 kGy and **(i)** rGO-50 kGy.

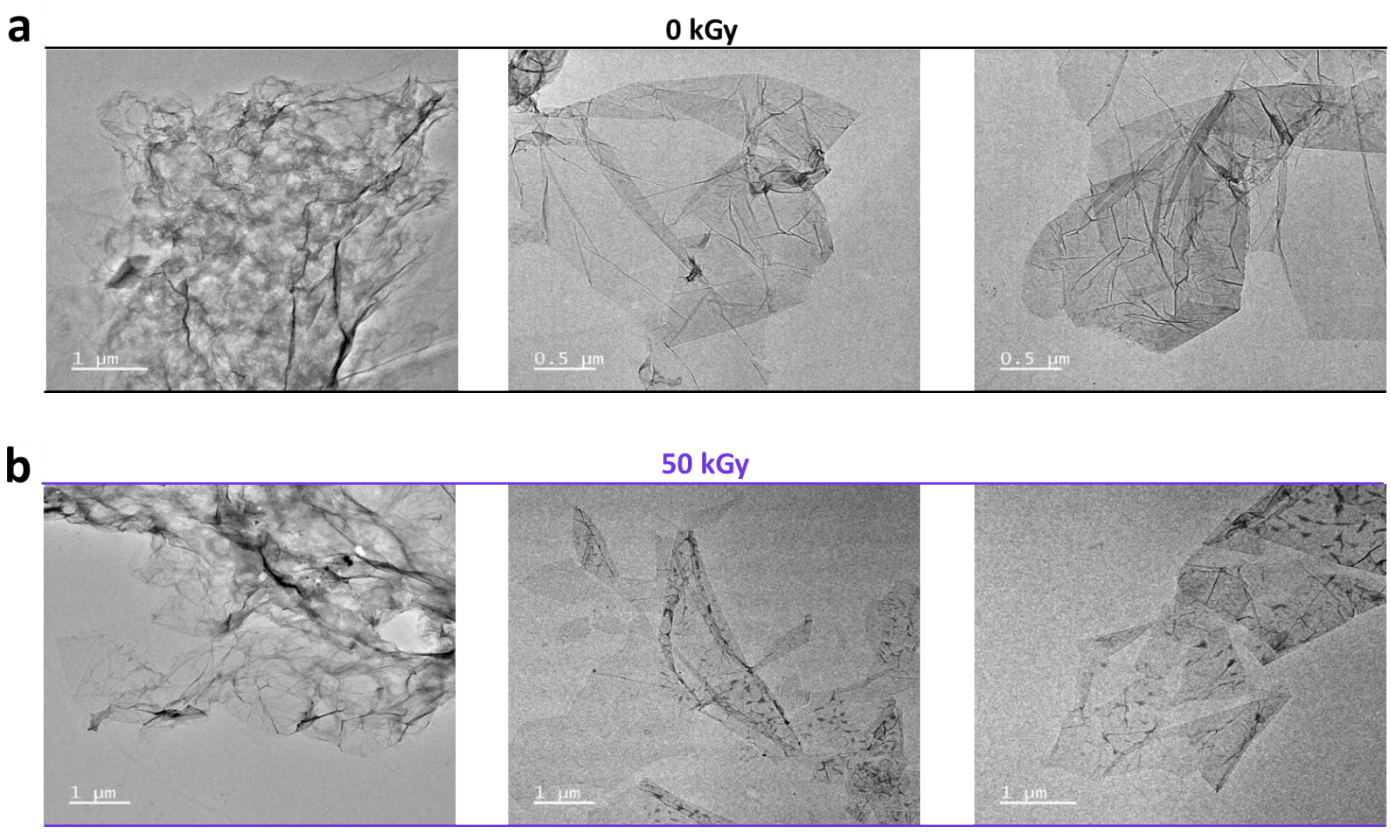

Figure S5. TEM images of **(a)** commercial GO (0.2 g L^{-1}) and **(b)** rGO-50 kGy (0.2 g L^{-1}) at different magnifications.

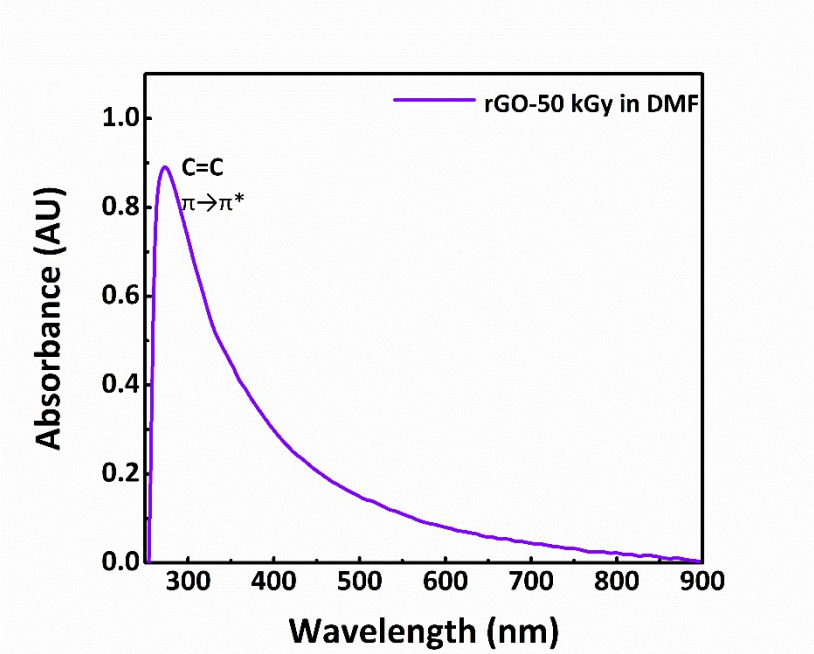

Figure S6. UV-Vis absorption spectra of rGO produced at an absorbed dose of 50 kGy in DMF following 2-hour ultrasonication at room temperature with an optical path length of 0.2 cm and DMF serving as reference.