

Article

Zwitterionic Functionalization of Persistent Luminescence Nanoparticles: Physicochemical Characterizations and In Vivo Biodistribution in Mice

Delphine Dassonville ^{1,†}, Thomas Lécuyer ^{1,*,†}, Johanne Seguin ¹, Yohann Corvis ¹, Jianhua Liu ¹, Guanyu Cai ¹, Julia Mouton ^{2,3}, Daniel Scherman ¹, Nathalie Mignet ¹ and Cyrille Richard ^{1,*}

¹ Unité de Technologies Chimiques et Biologiques pour la Santé (UTCBS), CNRS UMR8258, Inserm U1267, Université Paris Cité, 75006 Paris, France; nathalie.mignet@parisdescartes.fr

² EPF Graduate School of Engineering, 34000 Montpellier, France; julia.mouton@epf.fr

³ Polymers Composites and Hybrids, IMT Mines d'Alès, 30100 Alès, France; julia.mouton@epf.fr

* Correspondence: cyrille.richard@u-paris.fr

† These authors contributed equally to this work.

Supplementary Information

IR and NMR characterizations of SBS ligand

RMN ¹H (DMSO-d₆, 400 MHz): δ 0.5-0.6 (t, 2H), 1.6-1.8 (m, 2H), 1.9-2.0 (m, 2H), 2.4-2.5 (t, 2H), 3.0 (s, 6H), 3.1-3.3 (m, 2H), 3.3-3.4 (m, 2H), 3.5 (s, 9H).

FT-IR: (CH₂) = 2957 cm⁻¹, ν₁(SiOCH₃) = 2842 cm⁻¹, ν (C-C) = 1477 cm⁻¹, ν (C-N) = 1205 cm⁻¹, ν (S=O) = 1179 cm⁻¹, ν₂(SiOCH₃) = 1073 cm⁻¹.

Analytical and spectra data agreed with literature [1].

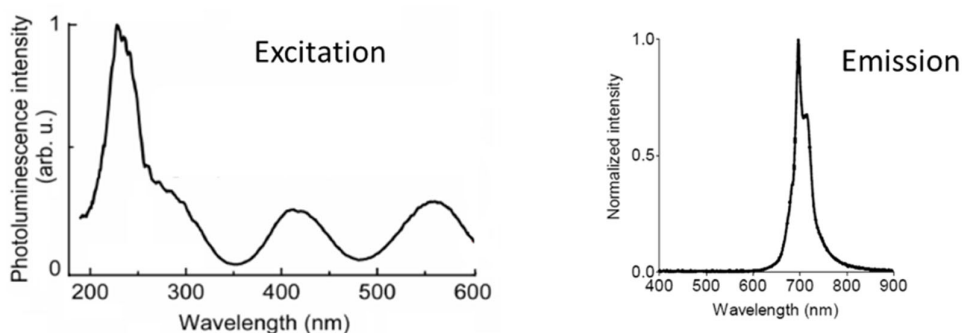


Figure S1. Excitation (left) and emission (right) spectra of ZGO NPs.

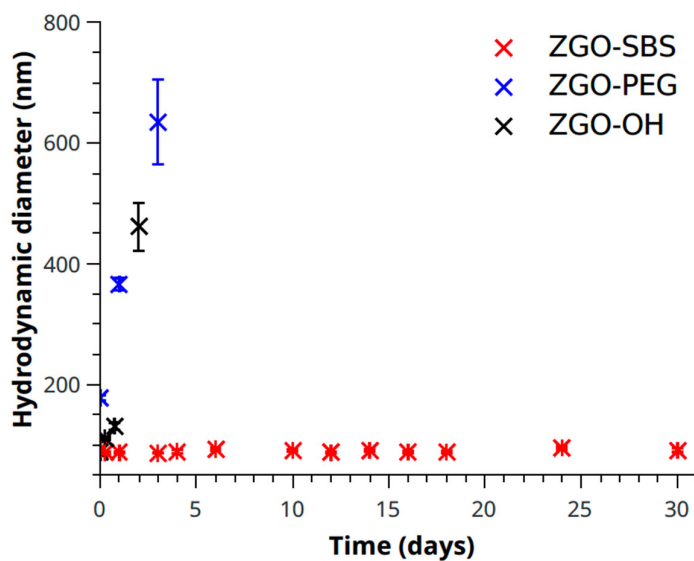


Figure S2. Stability of ZGO NPs with different coatings in water (2 mg/mL).

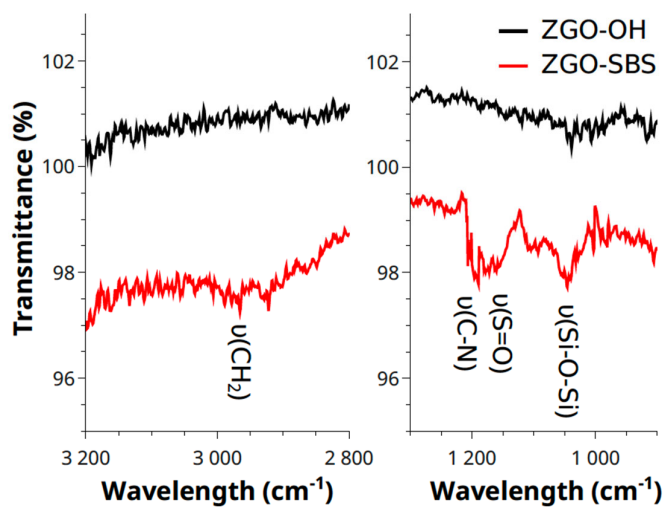


Figure S3. ATR FT-IR spectra of ZGO-OH (black) and ZGO-SBS (red).

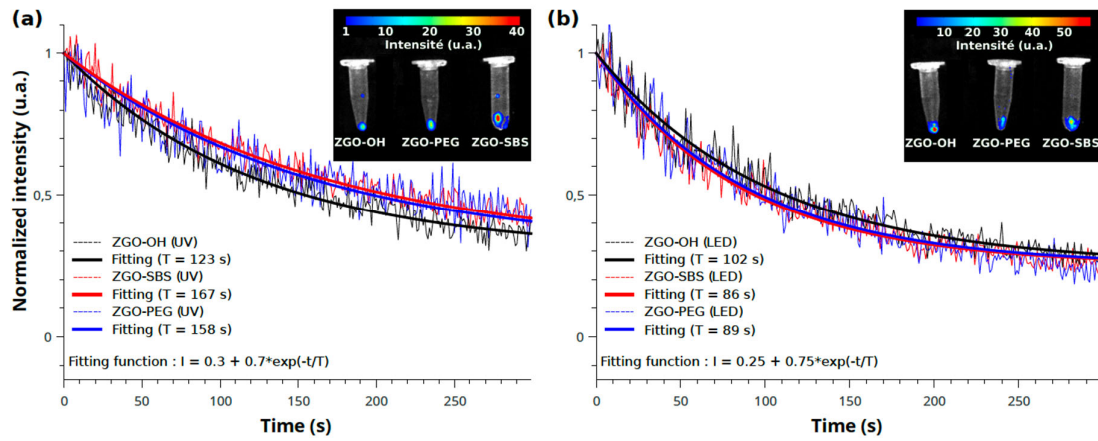


Figure S4. Persistent luminescence decay curves and intensity measurements (inset) of different ZGO NPs following (a) UV excitation and (b) LED (515 nm) excitation.

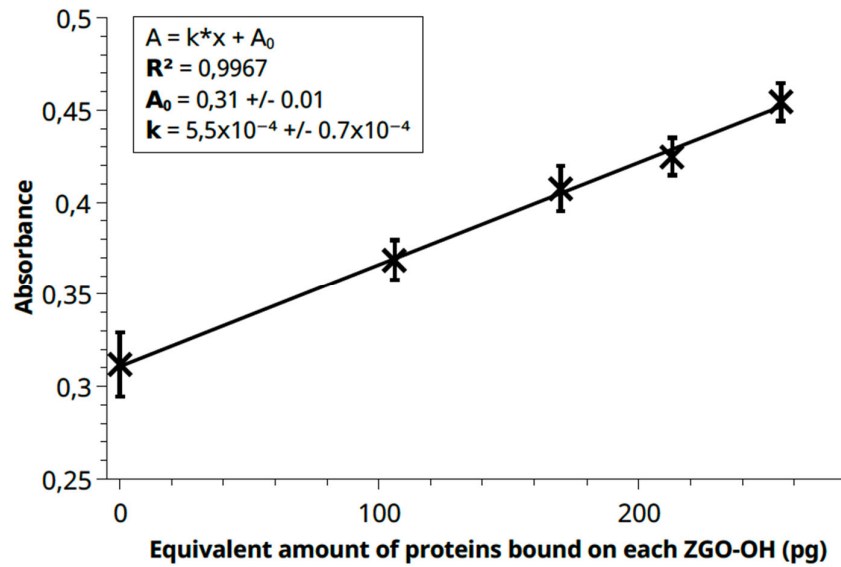


Figure S5. Calibration curve used to link absorbance at 595 nm to the amount of proteins grafted on ZGO-OH NPs made with known amounts of Human Serum Albumin (HSA).

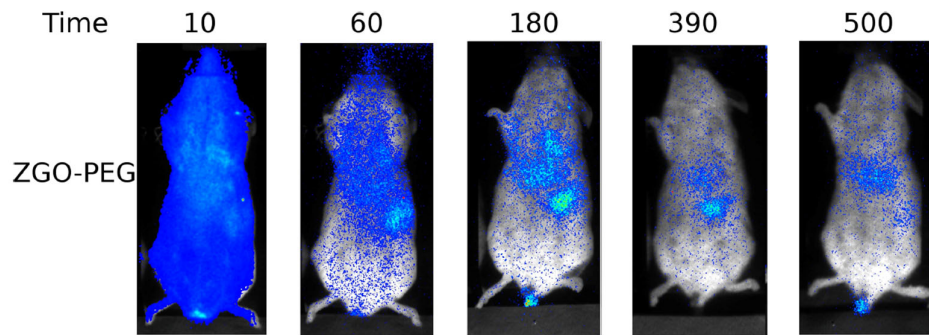


Figure S6. *In vivo* biodistribution of ZGO-PEG NPs in mice over the time (min).

Table S1. Influence of reaction time on ZGO functionalization with SBS.

	Reaction time	Δ HD (nm)	ZP (mv)	Stability (days)
SBS 5.5 w.e., pH 11, 80°C	3 h	+ 23	- 8	/
	6 h	+ 1	- 2	10
	Overnight	+ 103	+ 3	0

Table S2. Influence of ligand amount on ZGO functionalization with SBS.

	SBS (w.e.)	Δ HD (nm)	ZP (mv)	Stability (days)
pH 11, 80°C, 6 h	5.5	+1	-2	10
	11	+ 8	- 1	> 30
	15	+ 8	+ 1	> 30
	20	> 1000	/	0

Reference

1. Knowles, B.R.; Wagner, P.; Maclaughlin, S.; Higgins, M.J.; Molino, P.J. Silica Nanoparticles Functionalized with Zwitterionic Sulfobetaine Siloxane for Application as a Versatile Antifouling Coating System. *ACS Appl. Mater. Interfaces* **2017**, *9*, 18584–18594.