

Nitrogen Dioxide Optical Sensor Based on Redox-Active Tetrazolium/Pluronic Nanoparticles Embedded in PDMS Membranes

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Table S1. Dynamic light scattering characterization of TF nanoparticles stabilized with Pluronic F 127.

| ASC concentration | TTC concentration | Pluronic F127 concentration (M) | Size | Error | Zeta potential | Error | PDI | Error |
|-------------------|-------------------|---------------------------------|-------|-------|----------------|--------|-------|-------|
| 0.01 | 0.01 | 0.00005 | 114.2 | 1.604 | -0.5 | 0.439 | 0.346 | 0.046 |
| 0.01 | 0.01 | 0.00006 | 118.7 | 2.084 | 0.316 | 0.472 | 0.308 | 0.055 |
| 0.01 | 0.01 | 0.00007 | 120.1 | 3.213 | 1.07 | 0.198 | 0.308 | 0.028 |
| 0.01 | 0.01 | 0.00008 | 130.6 | 2.427 | 0.427 | 0.244 | 0.266 | 0.016 |
| 0.01 | 0.01 | 0.00009 | 132.2 | 0.2 | 0.59 | 0.565 | 0.268 | 0.014 |
| 0.01 | 0.01 | 0.0001 | 143.7 | 0.611 | 0.686 | 0.235 | 0.238 | 0.008 |
| 0.01 | 0.01 | 0.0002 | 193.5 | 5.468 | -0.782 | 0.0636 | 0.23 | 0.027 |
| 0.01 | 0.01 | 0.0003 | 202.0 | 1.25 | 1.02 | 0.348 | 0.231 | 0.008 |
| 0.01 | 0.01 | 0.0004 | 214.6 | 1.65 | 1.05 | 0.21 | 0.254 | 0.053 |
| 0.01 | 0.01 | 0.0005 | 270.1 | 9.445 | 0.597 | 0.13 | 0.227 | 0.06 |
| 0.01 | 0.01 | 0.001 | 305.7 | 16.44 | 0.451 | 0.162 | 0.284 | 0.073 |

Table S2. Dynamic light scattering characterization of TF nanoparticles stabilized with pluronic F 127 after 7 days.

| ASC concentration | TTC concentration | Pluronic F127 concentration (M) | Size | Error | Zeta potential | Error | PDI | Error |
|-------------------|-------------------|---------------------------------|-------|--------|----------------|--------|-------|-------|
| 0.01 | 0.01 | 0.00005 | 92.94 | 1.776 | 0.0907 | 0.303 | 0.475 | 0.032 |
| 0.01 | 0.01 | 0.00006 | 107.7 | 1.701 | 0.0831 | 0.0659 | 0.442 | 0.024 |
| 0.01 | 0.01 | 0.00007 | 99.77 | 0.4772 | 0.435 | 0.277 | 0.477 | 0.009 |
| 0.01 | 0.01 | 0.00008 | 103.5 | 0.1528 | 0.115 | 0.23 | 0.47 | 0.011 |
| 0.01 | 0.01 | 0.00009 | 91.44 | 1.315 | 0.151 | 0.0353 | 0.487 | 0.003 |
| 0.01 | 0.01 | 0.0001 | 118.8 | 2.427 | 0.585 | 0.308 | 0.362 | 0.04 |
| 0.01 | 0.01 | 0.0002 | 90.55 | 0.6749 | 1.2 | 0.0473 | 0.529 | 0.035 |

| | | | | | | | | |
|------|------|--------|-------|-------|------|--------|-------|-------|
| 0.01 | 0.01 | 0.0003 | 113.1 | 2.456 | 1.02 | 0.0765 | 0.442 | 0.021 |
| 0.01 | 0.01 | 0.0004 | 177.1 | 9.056 | 1.05 | 0.0814 | 0.432 | 0.015 |
| 0.01 | 0.01 | 0.0005 | 225 | 26.13 | 1.23 | 0.168 | 0.376 | 0.013 |
| 0.01 | 0.01 | 0.001 | 268.1 | 11.45 | 1.04 | 0.22 | 0.407 | 0.067 |

Table S3. Dynamic light scattering characterization of TF nanoparticles stabilized with pluronic F 127 after 14 days.

| ASC concentration | TTC concentration | Pluronic F127 concentration (M) | Size | Error | Zeta potential | Error | PDI | Error |
|-------------------|-------------------|---------------------------------|-------|--------|----------------|--------|-------|-------|
| 0.01 | 0.01 | 0.00005 | 90.36 | 1.665 | −0.621 | 0.096 | 0.512 | 0.031 |
| 0.01 | 0.01 | 0.00006 | 98.47 | 1.107 | −1.22 | 0.362 | 0.492 | 0.011 |
| 0.01 | 0.01 | 0.00007 | 93.15 | 1.395 | −0.577 | 0.198 | 0.48 | 0.021 |
| 0.01 | 0.01 | 0.00008 | 103.1 | 0.781 | −1.11 | 0.307 | 0.487 | 0.005 |
| 0.01 | 0.01 | 0.00009 | 83.38 | 1.049 | −1.16 | 0.213 | 0.533 | 0.008 |
| 0.01 | 0.01 | 0.0001 | 118.5 | 1.825 | −0.923 | 0.196 | 0.393 | 0.049 |
| 0.01 | 0.01 | 0.0002 | 99.44 | 1.093 | 0.218 | 0.128 | 0.466 | 0.026 |
| 0.01 | 0.01 | 0.0003 | 88.09 | 0.8774 | −0.352 | 0.251 | 0.454 | 0.01 |
| 0.01 | 0.01 | 0.0004 | 87.79 | 0.9455 | 0.346 | 0.0541 | 0.404 | 0.023 |
| 0.01 | 0.01 | 0.0005 | 131.4 | 1.323 | 0.864 | 0.151 | 0.399 | 0.046 |
| 0.01 | 0.01 | 0.001 | 275.5 | 6.087 | 1.08 | 0.292 | 0.424 | 0.024 |

Table S4. Dynamic light scattering characterization of TF nanoparticles stabilized with pluronic F 127 after 22 days.

| ASC concentration | TTC concentration | Pluronic F127 concentration (M) | Size | Error | Zeta potential | Error | PDI | Error |
|-------------------|-------------------|---------------------------------|-------|--------|----------------|--------|-------|-------|
| 0.01 | 0.01 | 0.00005 | 81.15 | 0.6194 | −2.21 | 0.455 | 0.533 | 0.007 |
| 0.01 | 0.01 | 0.00006 | 95.32 | 0.1097 | −3.25 | 0.25 | 0.503 | 0.01 |
| 0.01 | 0.01 | 0.00007 | 90.96 | 0.5256 | −1.02 | 0.466 | 0.498 | 0.01 |
| 0.01 | 0.01 | 0.00008 | 99.12 | 0.4674 | −1.96 | 0.27 | 0.486 | 0.016 |
| 0.01 | 0.01 | 0.00009 | 75.18 | 0.27 | −1.95 | 0.305 | 0.509 | 0.01 |
| 0.01 | 0.01 | 0.0001 | 112.5 | 2.261 | −3.17 | 0.466 | 0.441 | 0.037 |
| 0.01 | 0.01 | 0.0002 | 99.3 | 0.926 | −0.699 | 0.0811 | 0.495 | 0.001 |
| 0.01 | 0.01 | 0.0003 | 89.78 | 0.2223 | −0.733 | 0.143 | 0.463 | 0.007 |
| 0.01 | 0.01 | 0.0004 | 99.65 | 1.451 | −0.472 | 0.305 | 0.433 | 0.009 |
| 0.01 | 0.01 | 0.0005 | 139.5 | 0.8737 | −0.205 | 0.402 | 0.41 | 0.015 |
| 0.01 | 0.01 | 0.001 | 264.5 | 2.458 | −0.0811 | 0.227 | 0.478 | 0.016 |

Table S5. Dynamic light scattering characterization of TF nanoparticles stabilized with pluronic F 127 after 28 days.

| ASC concentration | TTC concentration | Pluronic F127 concentration (M) | Size | Error | Zeta potential | Error | PDI | Error |
|-------------------|-------------------|---------------------------------|-------|-------|----------------|-------|-------|-------|
| 0.01 | 0.01 | 0.00005 | 73.8 | 4.153 | −2.76 | 0.651 | 0.459 | 0.058 |
| 0.01 | 0.01 | 0.00006 | 88.19 | 2.513 | −3.46 | 0.806 | 0.462 | 0.035 |
| 0.01 | 0.01 | 0.00007 | 82.21 | 2.997 | −1.77 | 0.211 | 0.475 | 0.058 |
| 0.01 | 0.01 | 0.00008 | 87.22 | 3.198 | −2.53 | 0.73 | 0.468 | 0.016 |
| 0.01 | 0.01 | 0.00009 | 70.32 | 2.929 | −2.33 | 0.163 | 0.482 | 0.024 |
| 0.01 | 0.01 | 0.0001 | 96.04 | 3.646 | −3.4 | 0.143 | 0.462 | 0.02 |
| 0.01 | 0.01 | 0.0002 | 85.33 | 5.275 | −1.77 | 0.254 | 0.473 | 0.012 |
| 0.01 | 0.01 | 0.0003 | 83.75 | 2.289 | −1.54 | 0.344 | 0.429 | 0.003 |
| 0.01 | 0.01 | 0.0004 | 95.15 | 5.399 | −0.963 | 0.344 | 0.39 | 0.089 |
| 0.01 | 0.01 | 0.0005 | 139 | 12.62 | −0.265 | 0.651 | 0.31 | 0.137 |
| 0.01 | 0.01 | 0.001 | 230.9 | 25.32 | −0.738 | 0.364 | 0.214 | 0.157 |

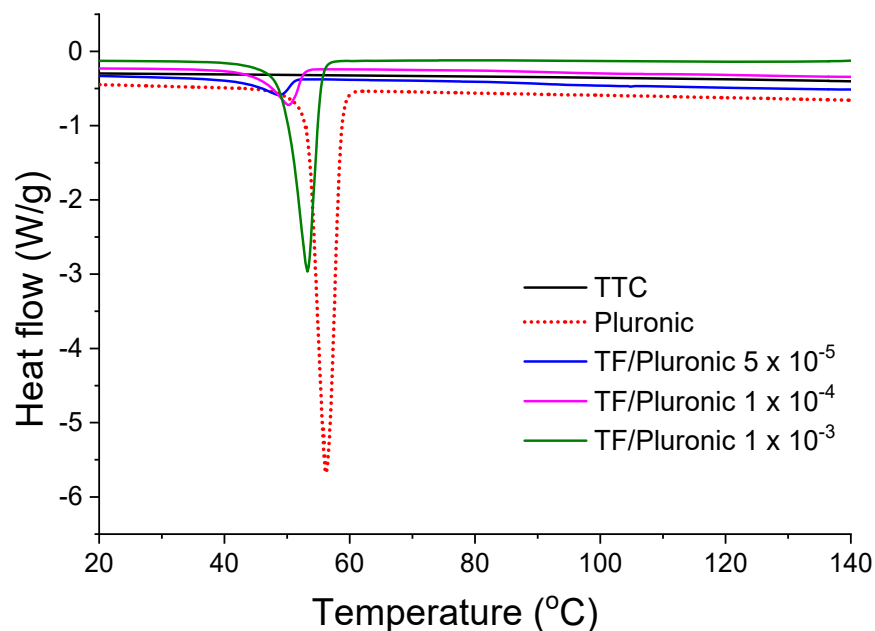
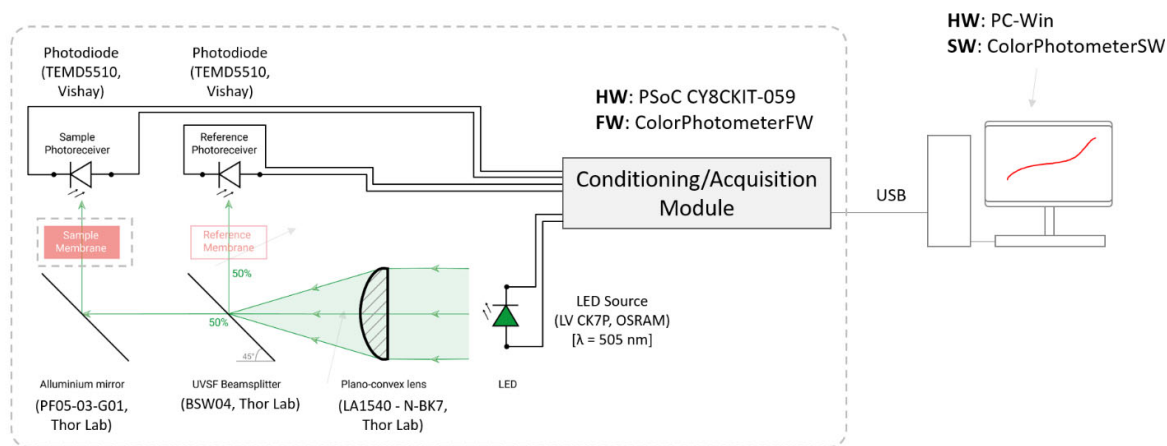


Figure S1. DSC analysis of TTC, Pluronic, and the dehydrated colloids form by TF and Pluronic at the concentration of 5×10^{-5} M, 10^{-4} M, and 10^{-3} M.



Dedicated case/enclosure was built by 3D printing (stl files available: "Case_bottom.STL"; "Case_center.STL"; "Case_top.STL" in "CaseColorPhotometer.zip")

Figure S2. Overview of the LED/photodiode-based colorimetric optical devices. All the material to reproduce the system (including hardware, firmware, and software) is available as an open-source resource at <https://doi.org/10.5281/zenodo.5825639>.

USB Connection to PC
(Power and Data)

PSoC CY8CKIT-059

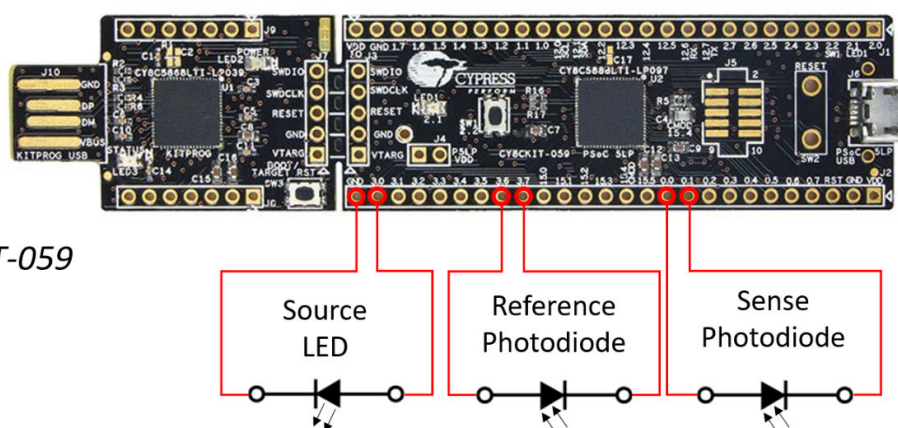


Figure S3. Electronic connections for the conditioning/acquisition module based on a low cost PSoC CY8CKIT-059 development board. The firmware is available as an open-source resource at <https://doi.org/10.5281/zenodo.5825639>.

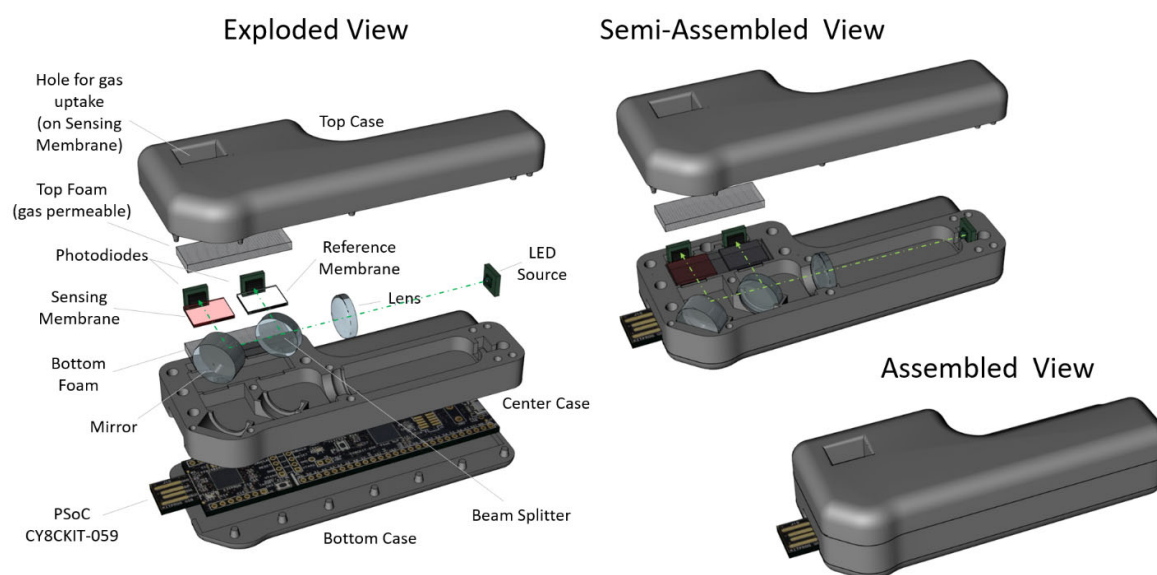


Figure S4. Overview of the colorimetric optical devices case/enclosure hardware: exploded (**left**) and related assembly (**right**).

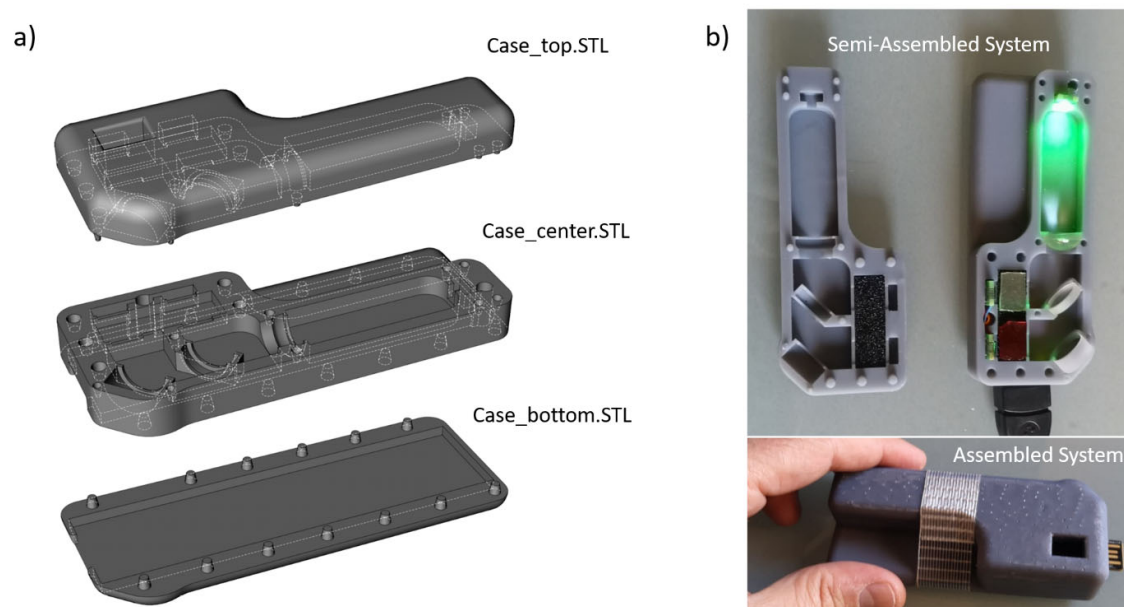


Figure S5. a) 3D CAD files of device case/enclosure hardware: stl files are available as an open-source resource at <https://doi.org/10.5281/zenodo.5825639>. b) Pictures of the assembled colorimetric optical devices.

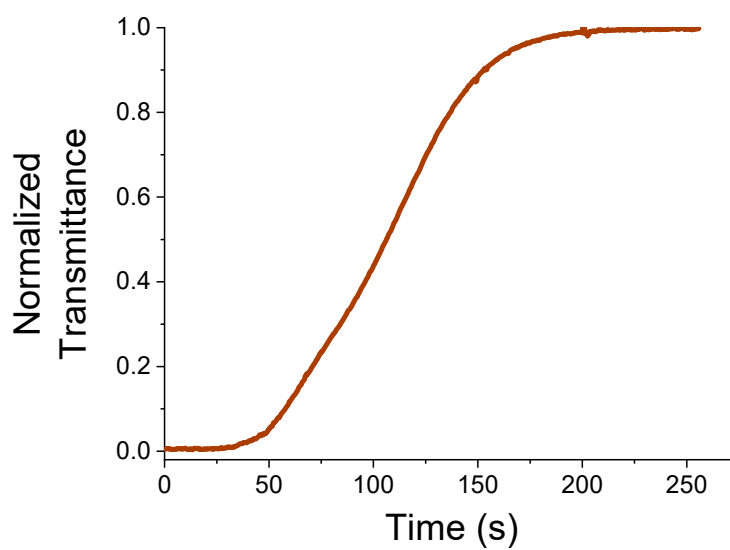


Figure S6. Preliminary NO₂ detection test with colorimetric optical devices in presence of an NO₂ excess.