Supplementary Information (SI) for Inorganic Chemistry Frontiers.
This journal is © the Partner Organisations 2026

# Supporting Information

# A Fluorescence Sensor Utilizing 3D COF Photonic Crystals for Enhanced Detection of TNP

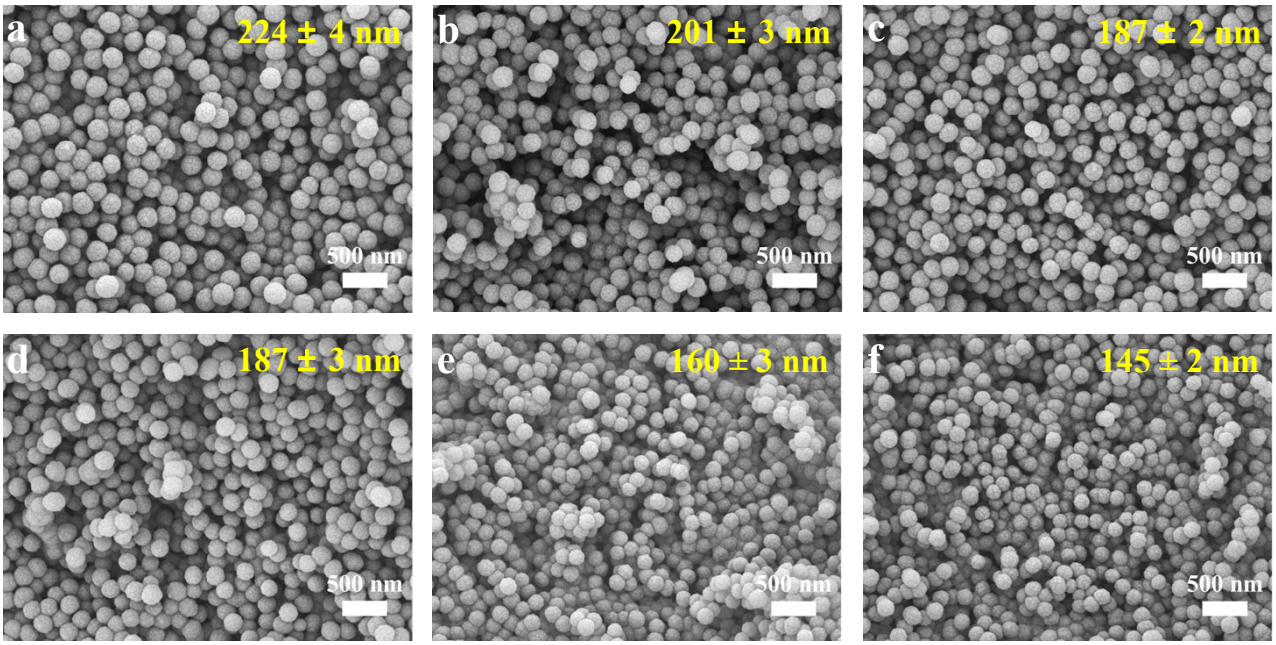



**Figure S1.** FE-SEM images of TAPB-BTCA-COF particles of (a) 224 ± 4 nm, (b) 201 ± 3 nm, (c) 187 ± 2 nm, (d) 187 ± 3 nm, (e) 160 ± 3 nm, and (f) 145 ± 2 nm.

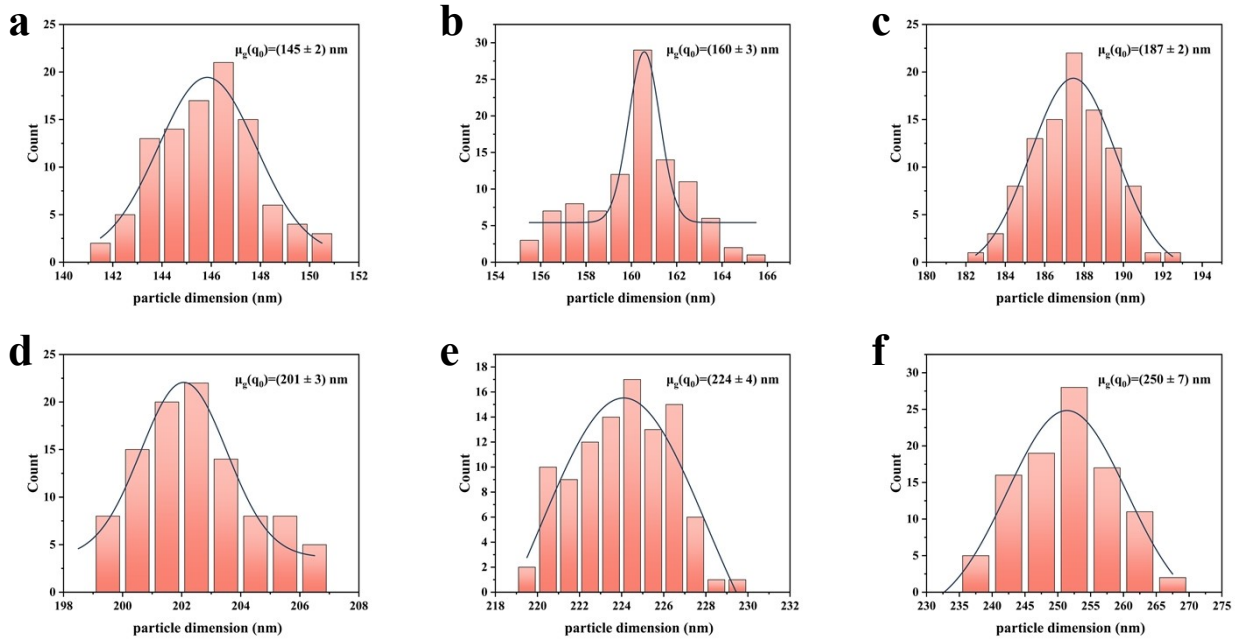
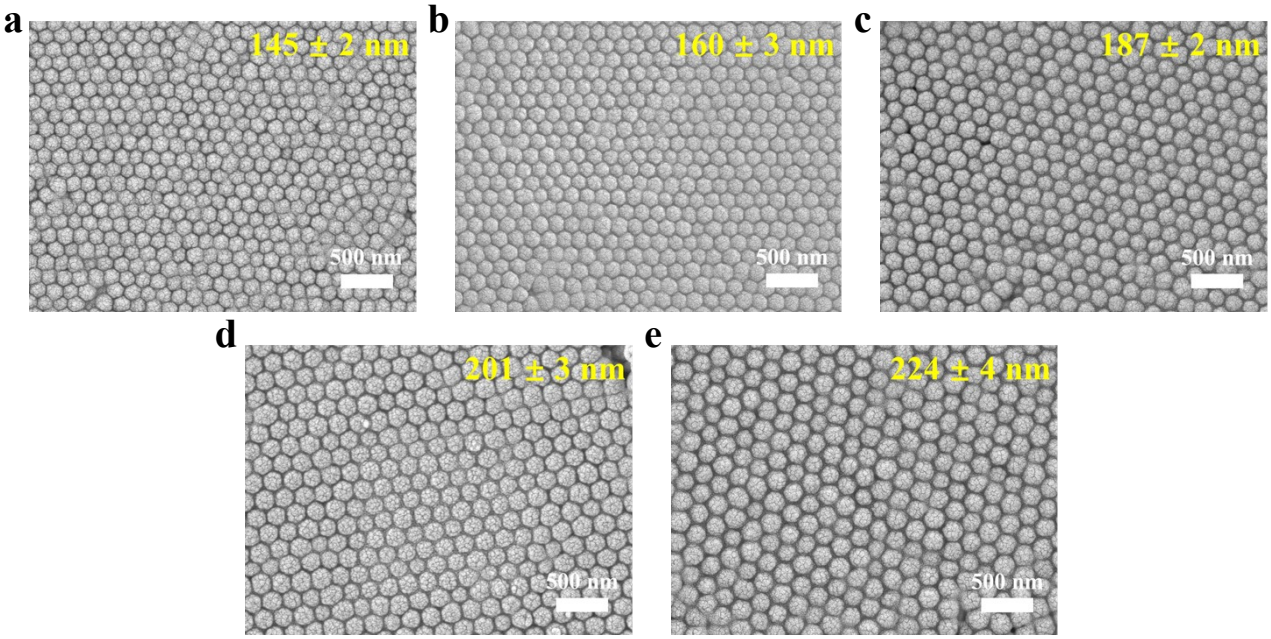
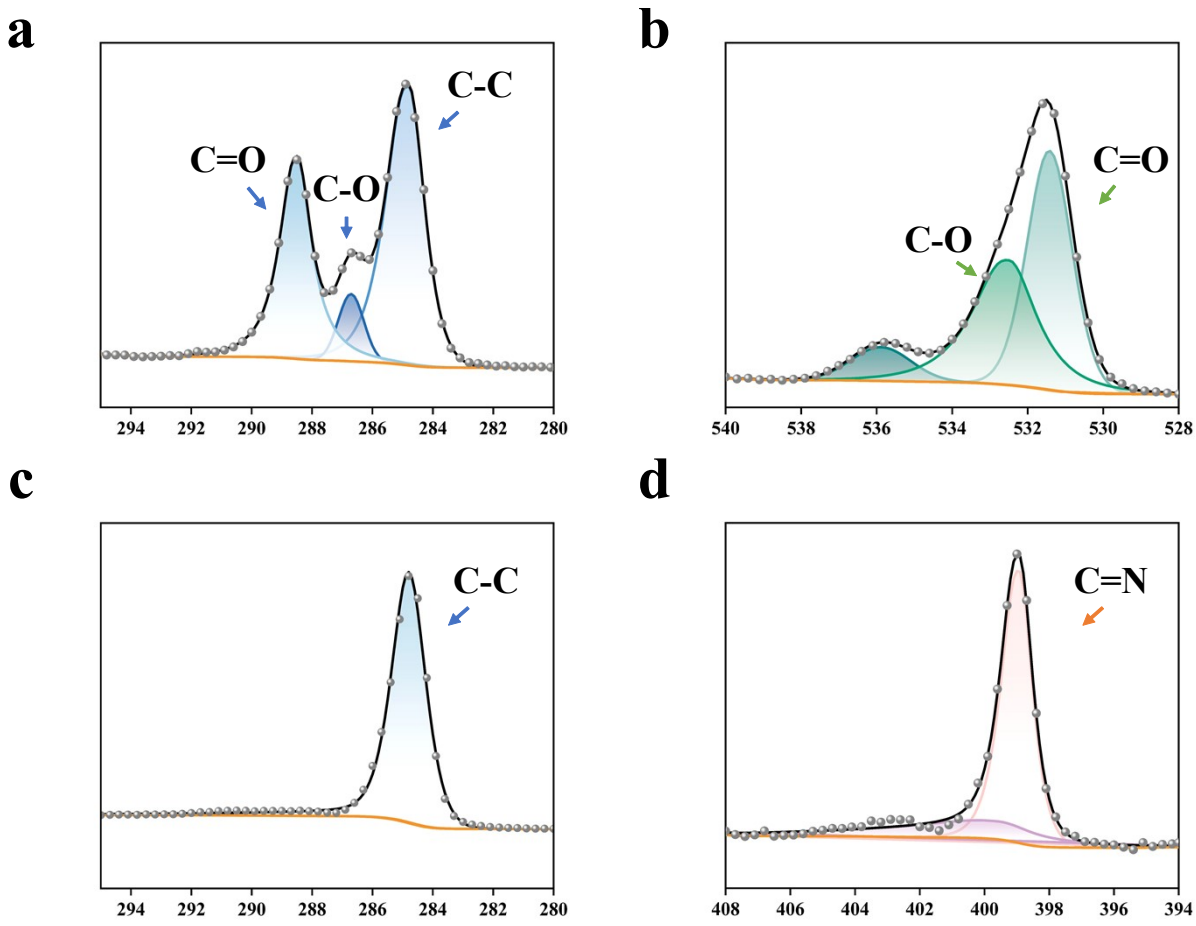



**Figure S2.** The particle size distribution of COF nanoparticles with (a) 145 ± 2 nm, (b) 160 ± 3 nm, (c) 187± 2 nm, (d) 201 ± 3 nm, (e) 224 ± 4 nm, and (f) 250 ± 7 nm.




**Figture S3.** FE-SEM images of superstructures comprising TAPB-BTCA-COF particles of (a) 145 ± 2 nm, (b) 160 ± 3 nm, (c) 187 ± 2 nm, (d) 201 ± 3 nm and (e) 224 ± 4 nm.




15

16 **Figture S4.** High-resolution XPS spectrum of (a) C 1s, (b) O 1s of FPTA NPs and (c) C 1s , (d) N 1s

17 of COF PhCs.

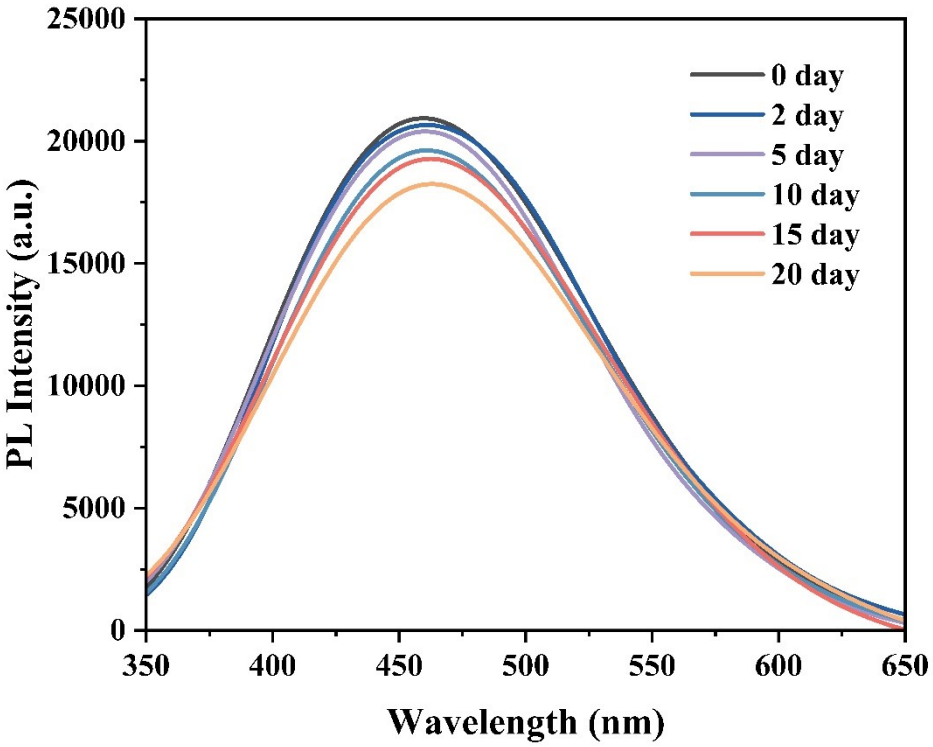



**Figure S5.** PL spectra changes of PhCs-FPTA NPs with time.

**Table S1.** Comparison with other mostprevious works for the detection of TNP

| No. | Detectable substance | Linear range | LOD | REF |
|---|---|---|---|---|
| 1 | GODs | 0.1–15 μM | 91 nM | 1 |
| 2 | Nph-An | 0–$1\times10^{-4}$ M | 470 nM | 2 |
| 3 | N-GQDs | 0–4 μM | 420 nM | 3 |
| 4 | CQD | 0.1–15.8 μM | 27 nM | 4 |
| 5 | Luminol-SiNPs | 0.08–1 μM | 22.4 nM | 5 |
| 6 | Zn（II）-MOF | 0–25μM | 0.32 μM | 6 |
| 7 | PEI-G PNP | 0.05–70μM | 26 nM | 7 |
| 8 | GQD-50 | 0–200 μM | 1.2 μM | 8 |
| 9 | RP-HPLC | 0.22–1.1 μM | 390 nM | 9 |
| 10 | Electrochemical | 28.4–436 μM | 43.6 nM | 10 |
| 11 | PhCs-based fluorescence sensor | 100–1000 nM | 20.7 nM | This work |

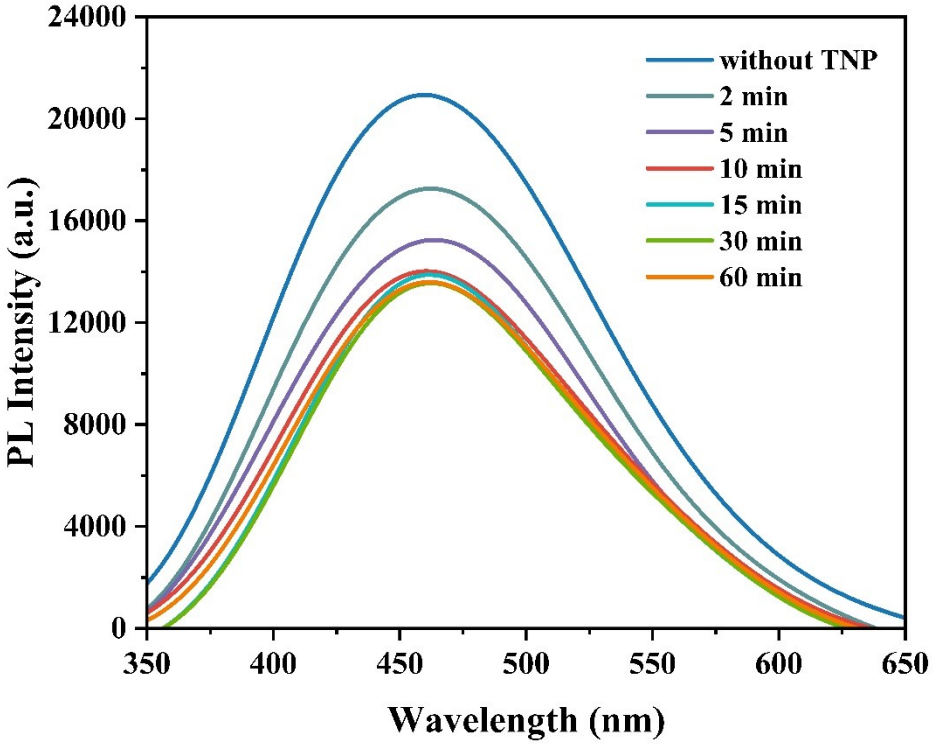



**Figure S6.** Time response of the PhC-based PL sensor for the detection of 500 nM TNP.

29 **Table S2.** Detection of TNP in simulated organic wastewater

| Sample | Spiked malathion (nM) | Measured (nM) | Recovery (%) | RSD (%) |
|---|---|---|---|---|
| Simulated organic wastewater | 0 | N/A* | — | — |
| | 50 | 50.6 | 101.2 | 3.56 |
| | 100 | 99.5 | 99.5 | 2.26 |
| | 500 | 505.4 | 101.1 | 2.73 |
| | 1000 | 987.3 | 98.7 | 4.3 |
| | 2000 | 2067.3 | 103.4 | 4.09 |

30 *The quenching index was lower than 5 %, so we assumed that TNP were not detected.

31

32

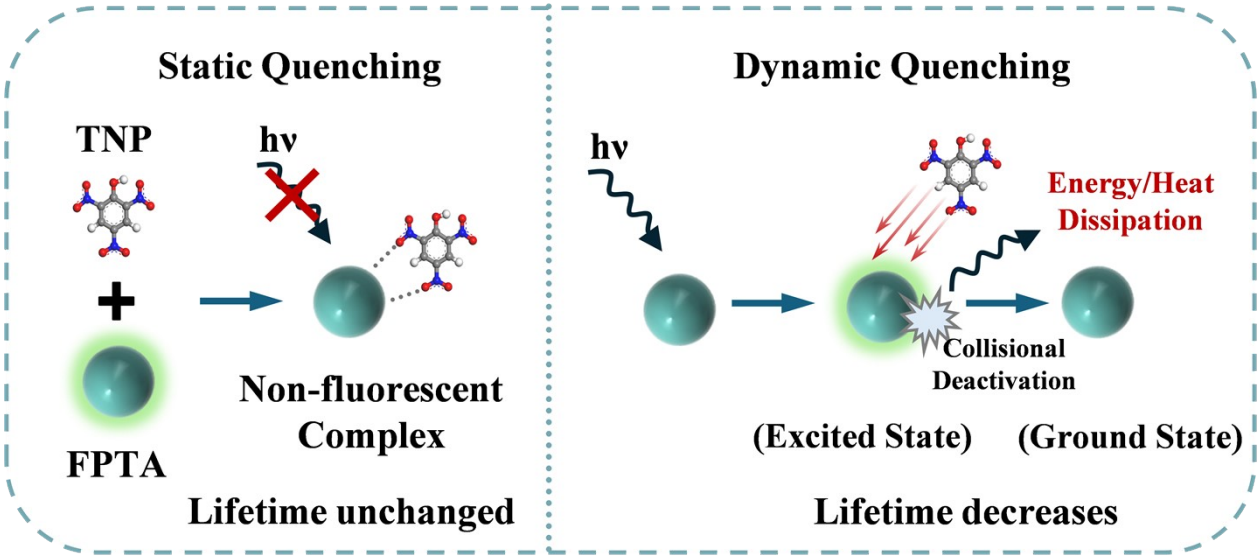



**Figure S7.** Illustration of the proposed fluorescence quenching mechanisms.

## References


1. Z. Li, Y. Wang, Y. Ni and S. Kokot,A sensor based on blue luminescent graphene quantum dots for analysis of a common explosive substance and an industrial intermediate, 2,4,6-trinitrophenol, Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2015, 137, 1213-1221.

2. H. Ma, C. He, X. Li, O. Ablikim, S. Zhang and M. Zhang,A fluorescent probe for TNP detection in aqueous solution based on joint properties of intramolecular charge transfer and aggregation-induced enhanced emission, Sensors and Actuators B: Chemical, 2016, 230, 746-752.

3. M. Kaur, S. K. Mehta and S. K. Kansal,Nitrogen doped graphene quantum dots: Efficient fluorescent chemosensor for the selective and sensitive detection of 2,4,6-trinitrophenol, Sensors and Actuators B: Chemical, 2017, 245, 938-945.

4. Y. Z. Fan, Q. Tang, S. G. Liu, Y. Z. Yang, Y. J. Ju, N. Xiao, H. Q. Luo and N. B. Li,A smartphone-integrated dual-mode nanosensor based on novel green-fluorescent carbon quantum dots for rapid and highly selective detection of 2,4,6-trinitrophenol and pH, Applied Surface Science, 2019, 492, 550-557.

5. W. Qi, Y. Fu, H. He, M. Zhao, D. Wu, L. Qi, L. Hu and R. Li,Electrochemiluminescence resonance energy transfer for both “turn-off” detection of 2,4,6-trinitrophenol and “turn-on” detection of lidocaine hydrochloride using luminol-doped silica nanoparticles, Sensors and Actuators B: Chemical, 2019, 287, 445-452.

6. T. Wiwasuku, J. Boonmak, K. Siriwong, V. Ervithayasuporn and S. Youngme,Highly sensitive and selective fluorescent sensor based on a multi-responsive ultrastable amino-functionalized Zn(II)-MOF for hazardous chemicals, Sensors and Actuators B: Chemical, 2019, 284, 403-413.

7. S. G. Liu, D. Luo, N. Li, W. Zhang, J. L. Lei, N. B. Li and H. Q. Luo,Water-Soluble

Nonconjugated Polymer Nanoparticles with Strong Fluorescence Emission for Selective and Sensitive Detection of Nitro-Explosive Picric Acid in Aqueous Medium, ACS Applied Materials & Interfaces, 2016, 8, 21700-21709.

8. D. Mukherjee, P. Das, S. Kundu and B. Mandal,Engineering of graphene quantum dots by varying the properties of graphene oxide for fluorescence detection of picric acid, Chemosphere, 2022, 300.

9. S. M. Ünsal and E. Erkan, Development and validation of a new RP-HPLC method for organic explosive compounds, Turk. J. Chem, 2022, 46, 923-928.

10. R. Manikandan, B. Kavitha, S. Rani and N. Senthil Kumar, Quantification of Picric Acid on Nanosphere Polypyrrole Modified Electrode by Stripping Voltammetry Method, J. Mex. Chem. Soc, 2019, 63, 146-154.