Supporting Information

Broadband Laser Protection and Enhanced Nonlinear Optical Response of Samarium-Metal–Organic Framework Based White/Black Carbon Hybrids

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Scheme S1 Schematic diagram of the experimental procedure used for preparing Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO hybrids.

Figure S2 EDS mapping images of Sm, C, O, B, N (a) Sm-MOF, (b) Sm-MOF/BN and (c) Sm-MOF/rGO hybrids.

Figure S3 EDS elemental spectra of (a) Sm-MOF, (b) Sm-MOF/BN and (c) Sm-MOF/rGO hybrids.

Figure S4 XPS spectra of Sm-MOF hybrids: (a) core spectrum of Sm 3d and (b) core spectrum of N 1s. XPS spectra of Sm-MOF/BN hybrids: core spectrum of (c) Sm 3d, (d) N 1s (e) B 1s and (f) O 1s. XPS spectra of Sm-MOF/rGO hybrids: core spectrum of (g) Sm 3d, (h) N 1s (i) O 1s and (j) C 1s.

Figure S5. XRD of Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO hybrids and (*) indicate the rGO and BN.

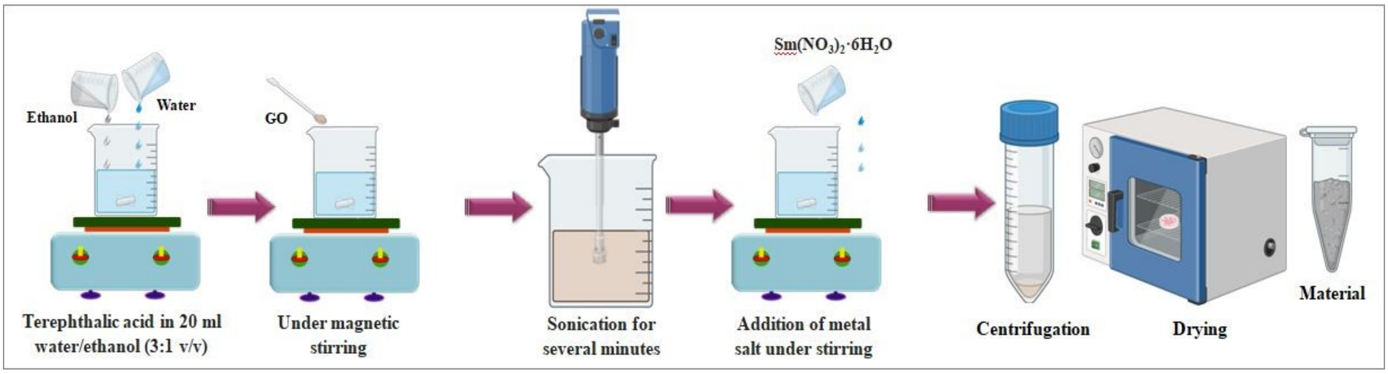
Figure S6 PL emission spectra of Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO hybrids.

Figure S7 Life time decay curve of(a) Sm-MOF, (b) Sm-MOF/BN and (c) Sm-MOF/rGO hybrids.

Figure S8 Energy level diagrams of hybrid materials at different wavelengths: 2PA process at 600 nm and 3PA process at 700-1000 nm.

Table S1. Comparison of the surface area of Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO by BET technique.

Table S2. The nonlinear absorption coefficients of other composites, excited under femtosecond laser excitations.



Scheme S1: Schematic diagram of the experimental procedure used for preparing Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO.

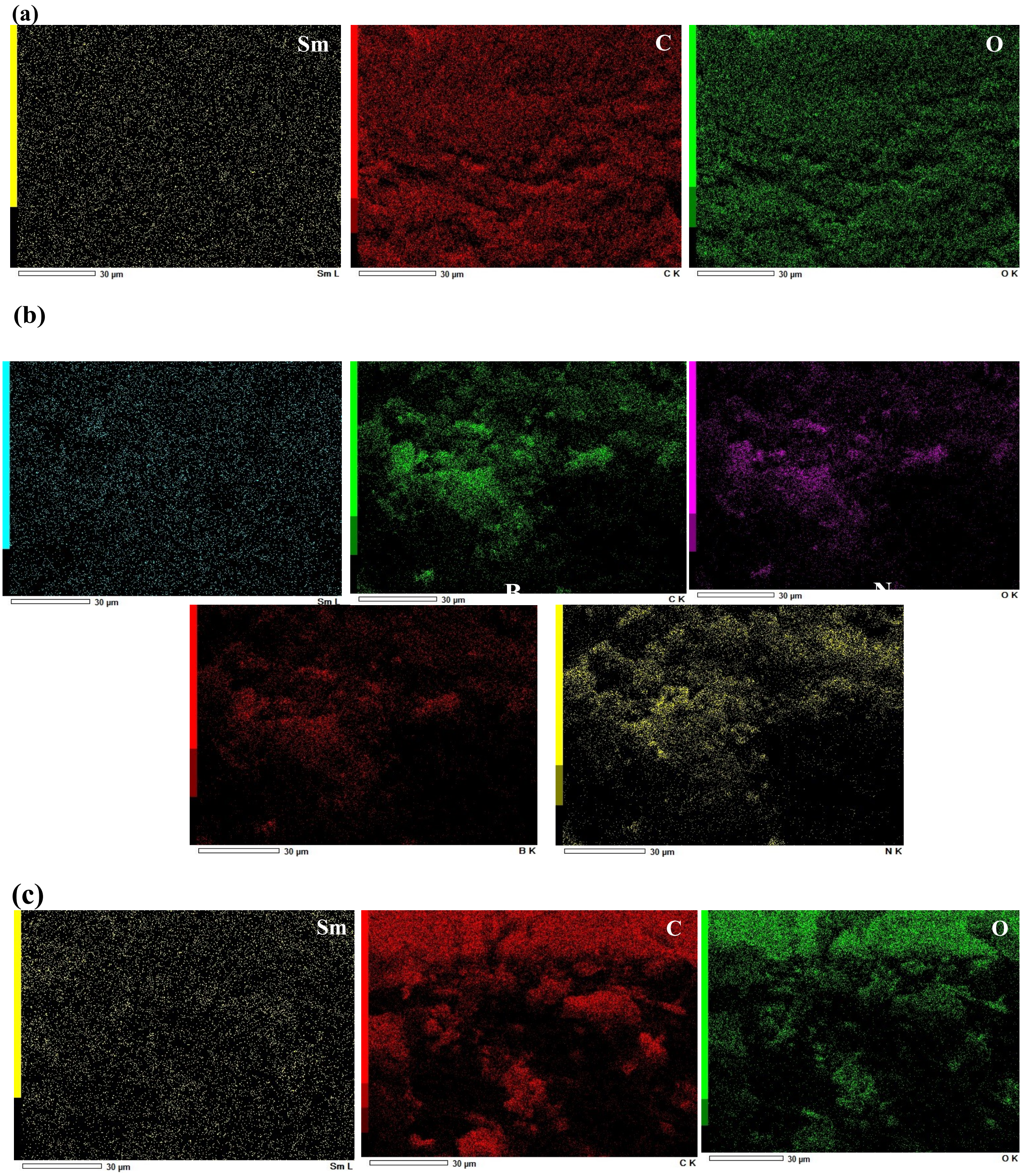


Figure S2: EDS mapping images of Sm, C, O, B, N (a) Sm-MOF, (b) Sm-MOF/BN and (c) Sm-MOF/rGO.

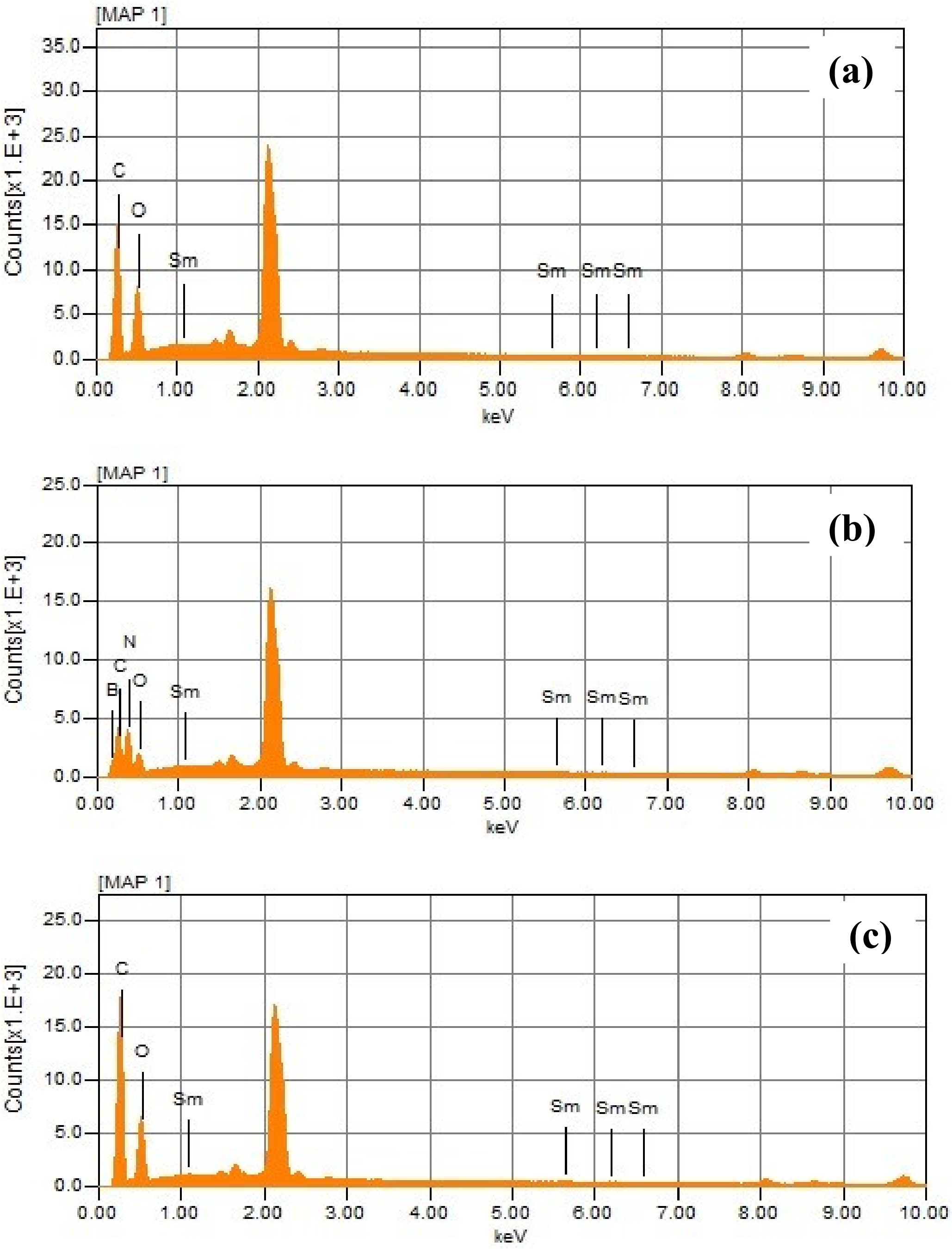


Figure S3: EDS elemental spectra of (a) Sm-MOF, (b) Sm-MOF/BN and (c) Sm-MOF/rGO.

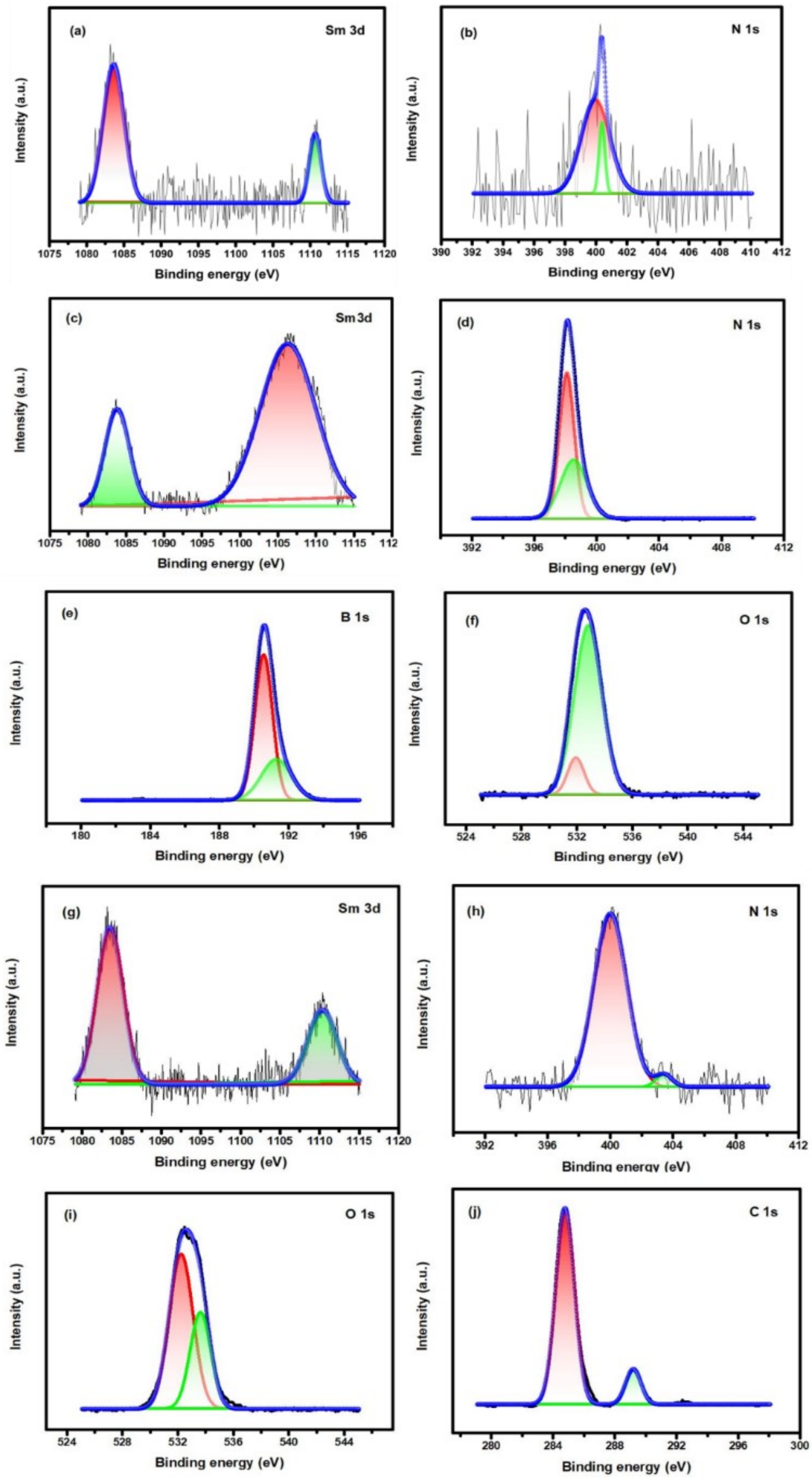


Figure S4: XPS spectra of Sm-MOF hybrids: (a) core spectrum of Sm 3d and (b) core spectrum of N 1s. XPS spectra of Sm-MOF/BN hybrids: core spectrum of (c) Sm 3d, (d) N 1s (e) B 1s and (f) O 1s. XPS spectra of Sm-MOF/rGO hybrids: core spectrum of (g) Sm 3d, (h) N 1s (i) O 1s and (j) C 1s.

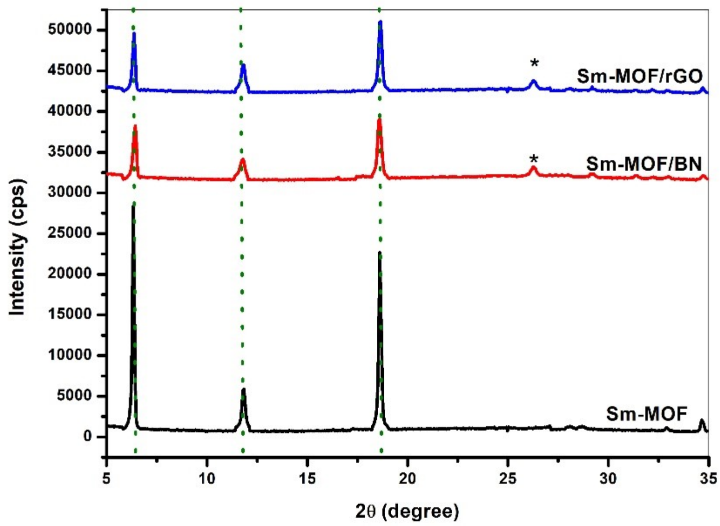


Figure S5: XRD of Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO hybrids and (*) indicate the rGO and BN.

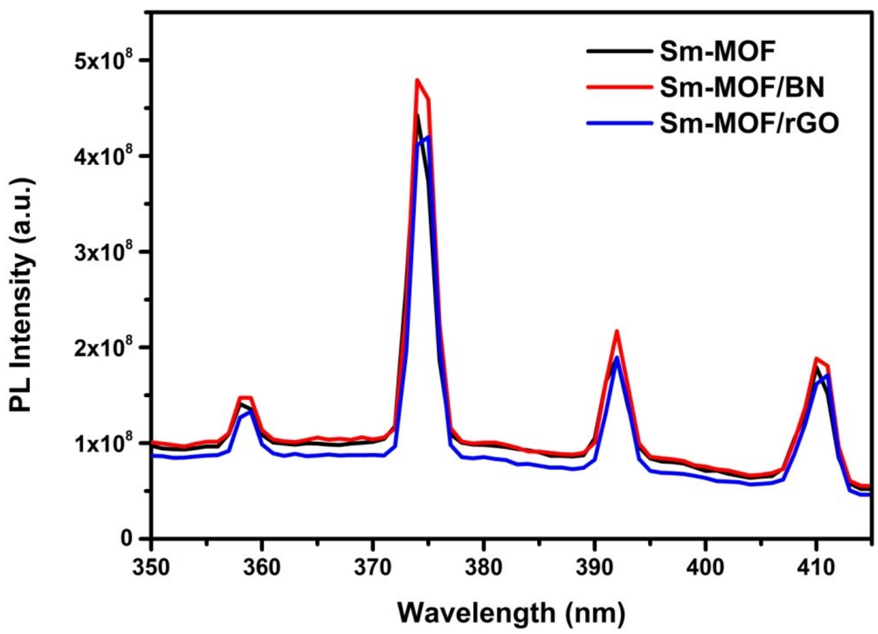


Figure S6: PL emission spectra of Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO

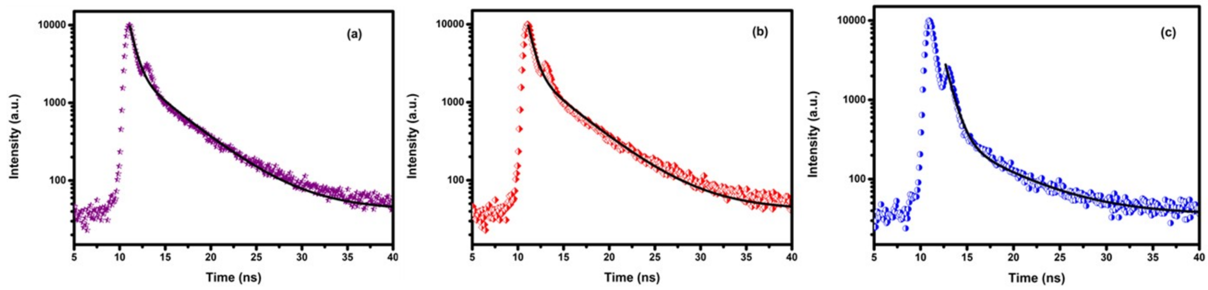


Figure S7: Life time decay curve of (a) Sm-MOF, (b) Sm-MOF/BN and (c) Sm-MOF/rGO

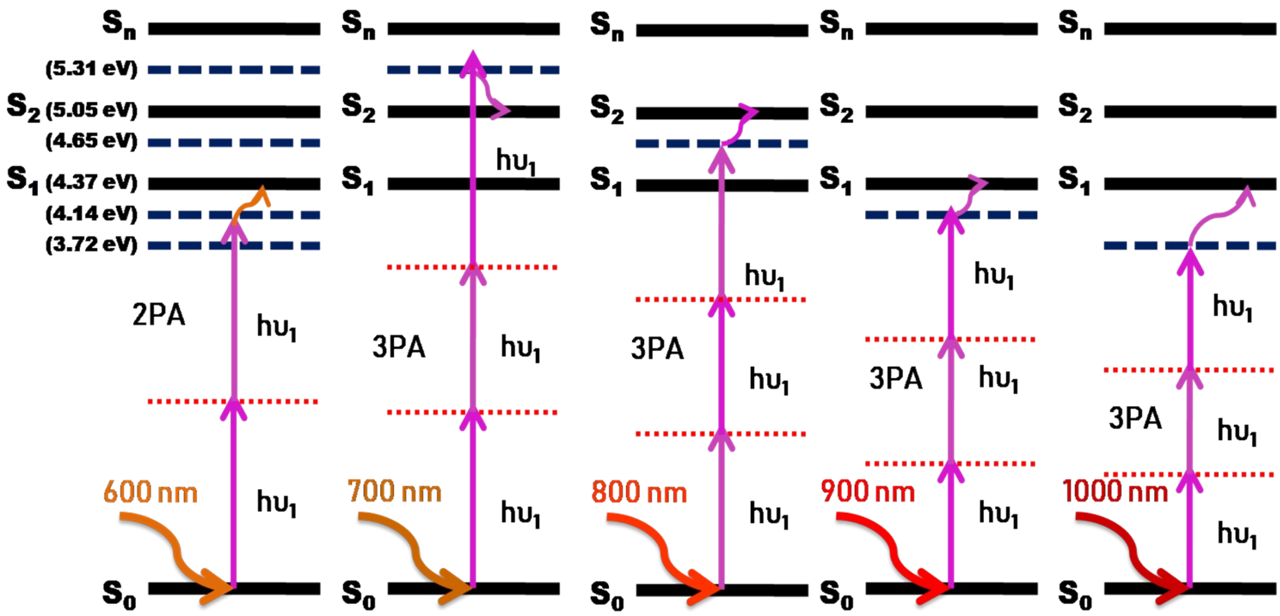


Figure S8: Energy level diagrams of hybrid materials at different wavelengths: 2PA process at 600 nm and 3PA process at 700-1000 nm.

Table S1: Comparison of the surface area of Sm-MOF, Sm-MOF/BN and Sm-MOF/rGO by BET technique.

Sample	Surface area (m^2/g)	Pore Radius (Å)	Pore volume (cc/g)
Sm-MOF	160.1 m^2/g	15.4	0.246 cc/g
Sm-MOF/BN	210.4 m^2/g	16.1	0.311 cc/g
Sm-MOF/rGO	276.9 m^2/g	16.2	0.472 cc/g

Table S2: The nonlinear absorption coefficients of other composites, excited under femtosecond laser excitations.

Compound	Experimental condition (Laser excitation)	Nonlinear absorption coefficient	References
rGO	800 nm, (100 fs)	8.0×10^{-15}(m/W) (2PA)	[1]
GO	800 nm (100 fs, 1 kHz)	0.47 $cm^3 \cdot GW^{-2}$ (3PA)	[2]

$BiFe_2O_4$-$NaNbO_3$	800 nm (100 fs)	1.1×10^{-14}(m/W) (2PA)	[3]
HAgNC-590	808 nm (100 fs, 1 kHz)	0.0075 (cm/GW) (2PA)	[4]
Ag-Fe_2O_4-rGO	800 nm (150 fs, 80 MHz)	3.8×10^{-10}(m/W) (2PA)	[5]
$5Li_2O$–50ZnO–$40B_2O_3$–$5Sm_2O_3$	700 nm (50 fs, 1 kHz)	1.84 (10^{-11} m/W) (2PA)	[6]
rGO–ZnSe	808 nm (150 fs, 1 kHz)	(0.14–0.2 cm GW^{-1}(2PA)	[7]
Au-Fe_2O_4-rGO	800 nm (150 fs, 80 MHz)	9.3×10^{-10}(m/W) (2PA)	[8]

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