Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.


# Giant enhancement of anti-quenching upconversion luminescence in $Sc_2W_3O_{12}:Er^{3+}/Yb^{3+}$ phosphors for temperature sensing

Xufang Wang[a], Ping Zhang[a], Xianglong Xiao[a], Ruoshan Lei[a], Lihui Huang[a], Shiqing Xu[a], Shilong Zhao[a,*], Xiuli Wang[b,*]

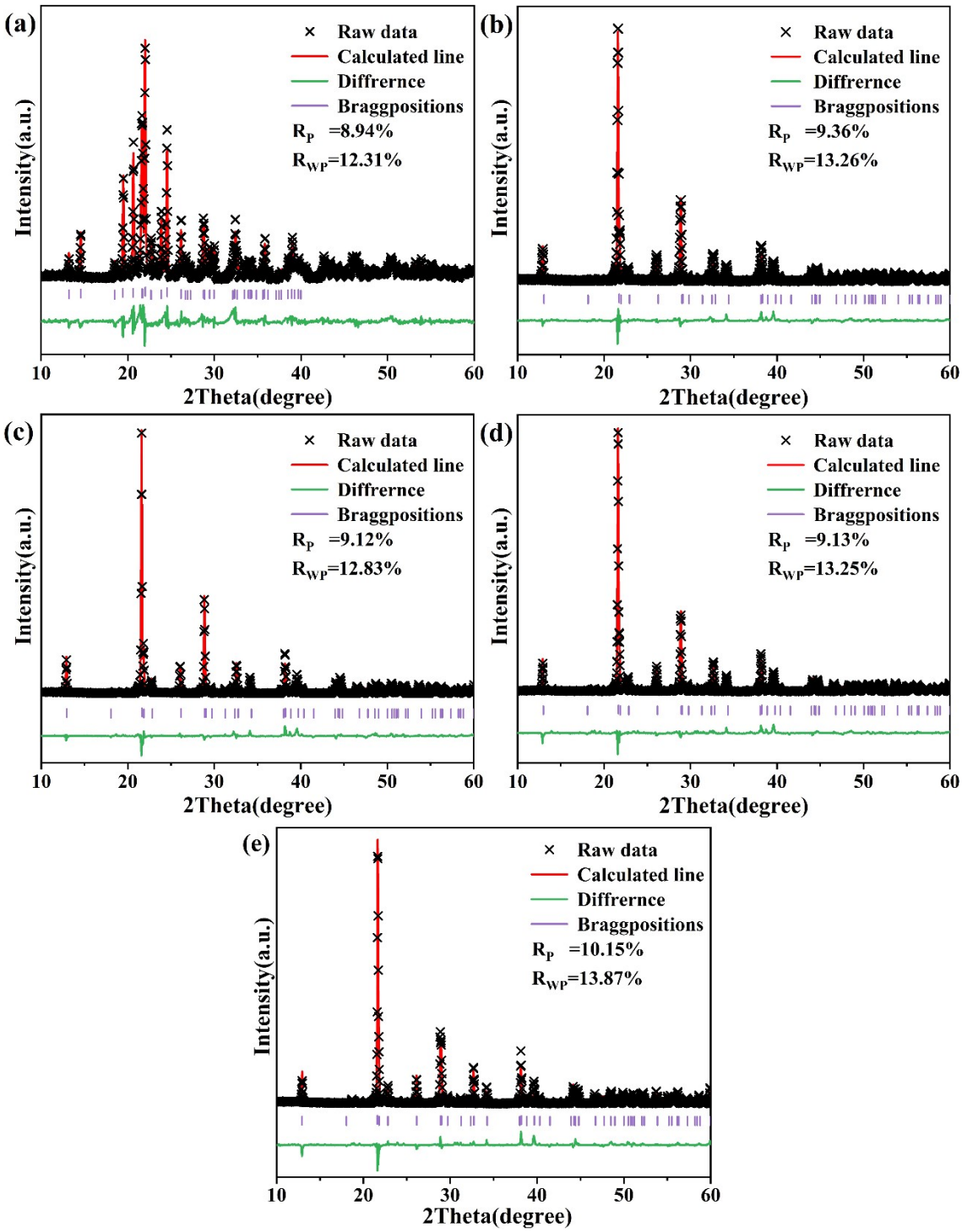


**Fig.S1** Rietveld analysis of $(KMg)_xSc_{2-x}W_3O_{12}$: 1 mol%$Er^{3+}$/20 mol%$Yb^{3+}$ ($x$ = 0, 0.5, 0.6, 0.75, 1, 1.25) phosphor.

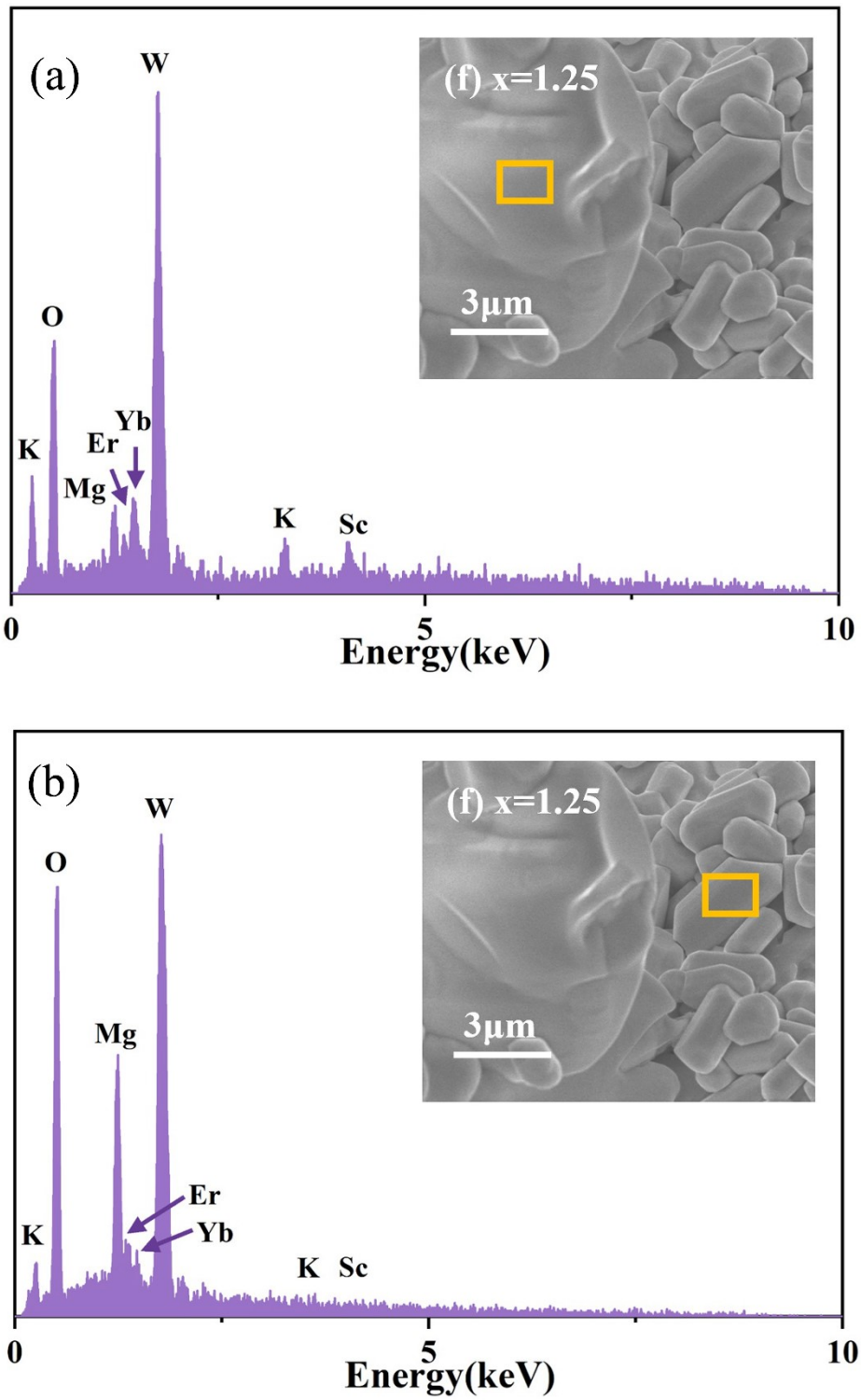


**Fig.S2** EDX spectra of different particles in $(KMg)_{1.25}Sc_{0.75}W_3O_{12}$:1 mol%$Er^{3+}$/20 mol%$Yb^{3+}$ phosphors.

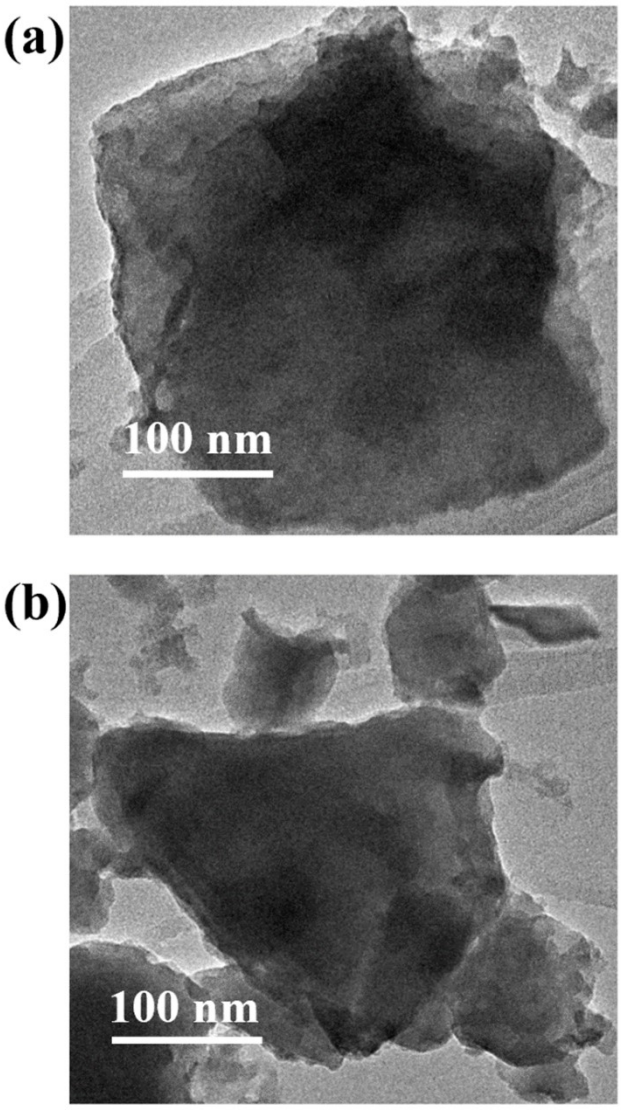


**Fig.S3** (a,b) TEM image of (KMg)$ScW_3O_{12}$:1 mol%$Er^{3+}$/20 mol%$Yb^{3+}$ phosphors.

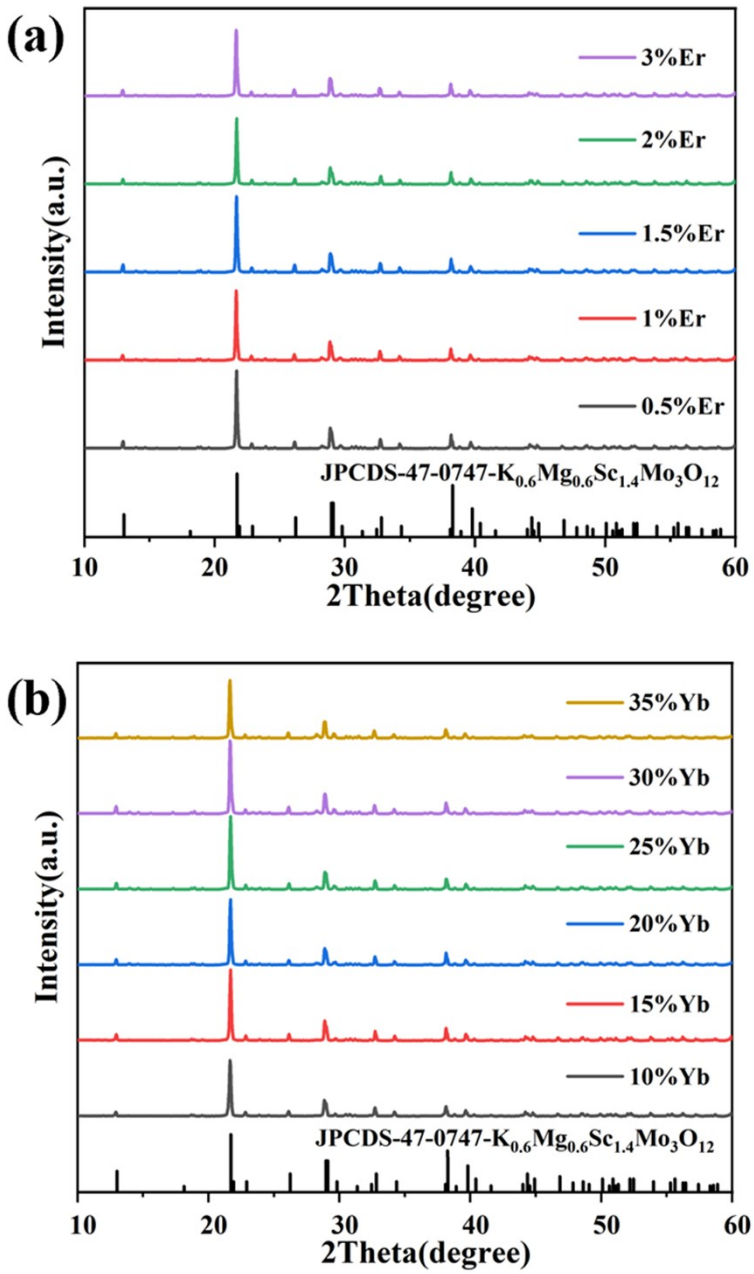


**Fig.S4** XRD patterns of (a) (KMg)$ScW_3O_{12}$: *a* mol%$Er^{3+}$/20 mol%$Yb^{3+}$( *a* = 0.5, 1, 1.5, 2, 3 ) and (b) (KMg)$ScW_3O_{12}$: 2 mol%$Er^{3+}$/*b* mol%$Yb^{3+}$ ( *b* = 10, 15, 20, 25, 30,35 ).

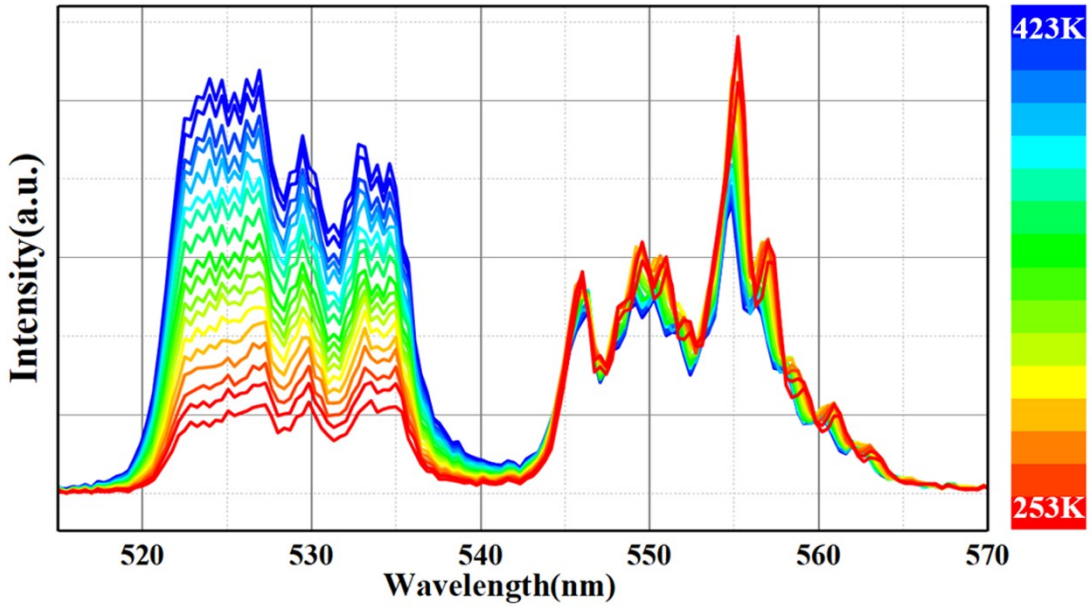


**Fig.S5** The dependence of green upconversion emission spectra on the temperature based on fiber optic system.

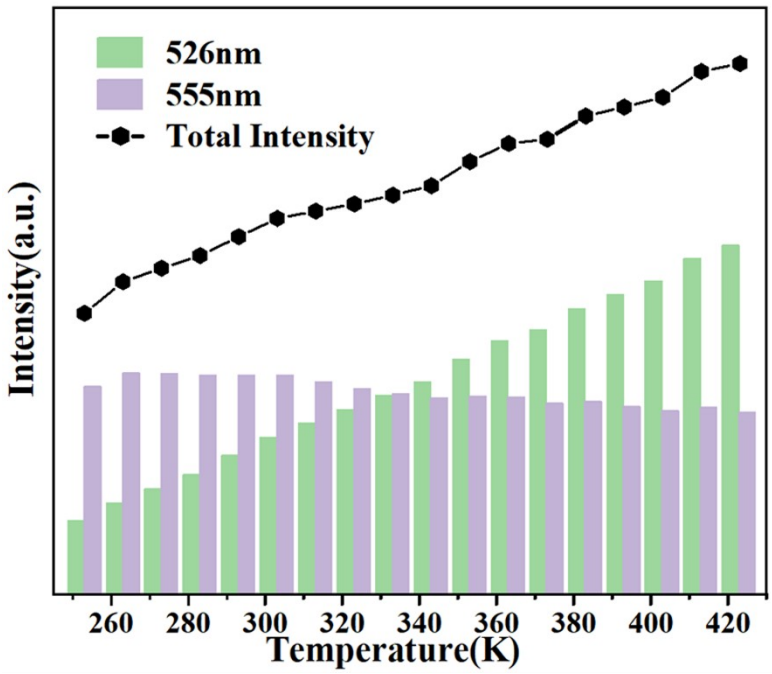


**Fig.S6** The dependence of integrated upconversion intensity on temperature.

Table S1 Temperature sensing properties of A2M3O12 material

| Materials | Temperature range(K) | Sa($K^{-1}$) | Sr($K^{-1}$) | Ref. |
|---|---|---|---|---|
| $Y_2Mo_3O_{12}$:Er/Yb | 303-583 | 0.0068 | 0.0097 | S1 |
| $Y_2W_3O_{12}$:Er/Yb | 303-523 | 0.0041 | 0.0093 | S2 |
| $Al_2Mo_3O_{12}$:Er/Yb | 303-603 | 0.0111 | 0.0109 | S3 |
| $Sc2Mo_30_{12}$:Er/Yb | 303-573 | 0.0001 | 0.0106 | S4 |
| $Sc_2W_3O_{12}$:Er/Yb | 403-753 | 0.008 | 0.0083 | S5 |
| (KMg)$ScW_3O_{12}$:Er/Yb | 253-573 | 0.0117 | 0.0165 | This work |

**Reference:**


[S1] H. Lv, P. Du, L. Luo, W. Li. *Adv. Mater.*, 2021, **2**, 2642.

[S2] X. Lai, W. Li, L. Luo, P. Du. *J.Alloy.Compd.*, 2024, **976**, 173311.

[S3] H. Lv, L. Liu, D. Wang, Z. Mai, F. Yan, G. Xing, P. Du. *J. Lumin.*, 2022, **252**, 119333.

[S4] W. Liu, S. Xu, L. Lei. *Opt. Mater.,* 2023, **143**, 114166.

[S5] Q. Wang, J. Wen, J. Zheng, Q. Xia, C. Wei, X. Huang, Z. Mu, F. Wu. *J. Lumin.*, 2022, **252**, 119306.

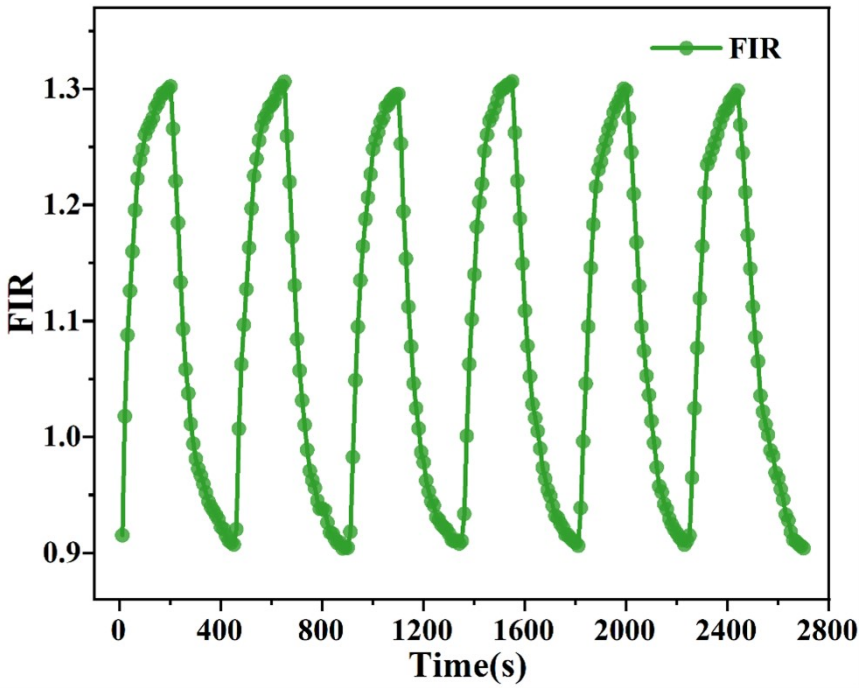


**Fig.S7** FIR changes in CPU thermal cycling testing.

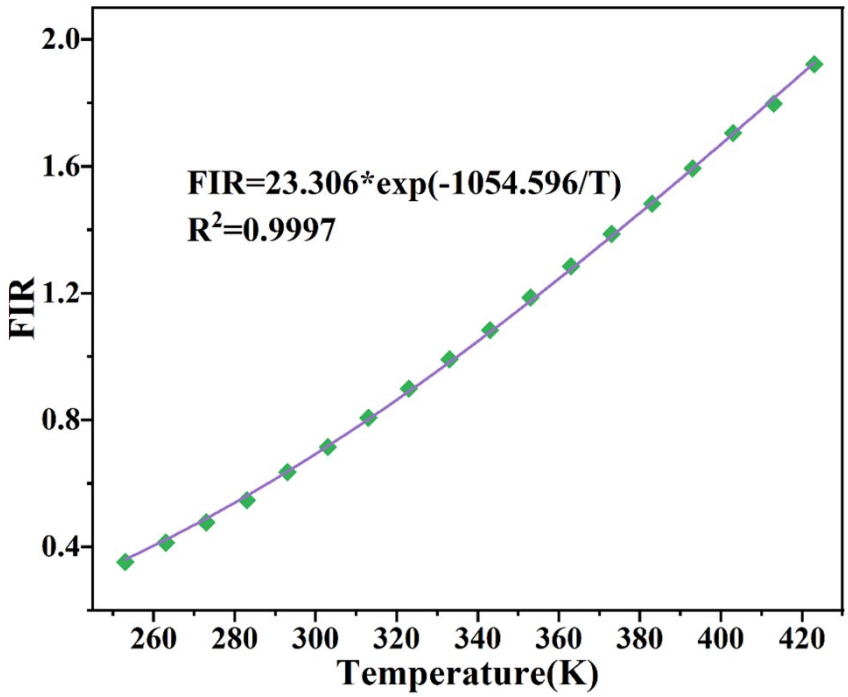


**Fig.S8** Linear fit between FIR and temperature in thermostat bath testing.