

**Flexible Translucent Persistent Luminescence Films Based on  
Sr<sub>2</sub>MgSi<sub>2</sub>O<sub>7</sub>:Eu<sup>2+</sup>,Dy<sup>3+</sup> Cellulose Ether Composites**

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**Supplementary Information**

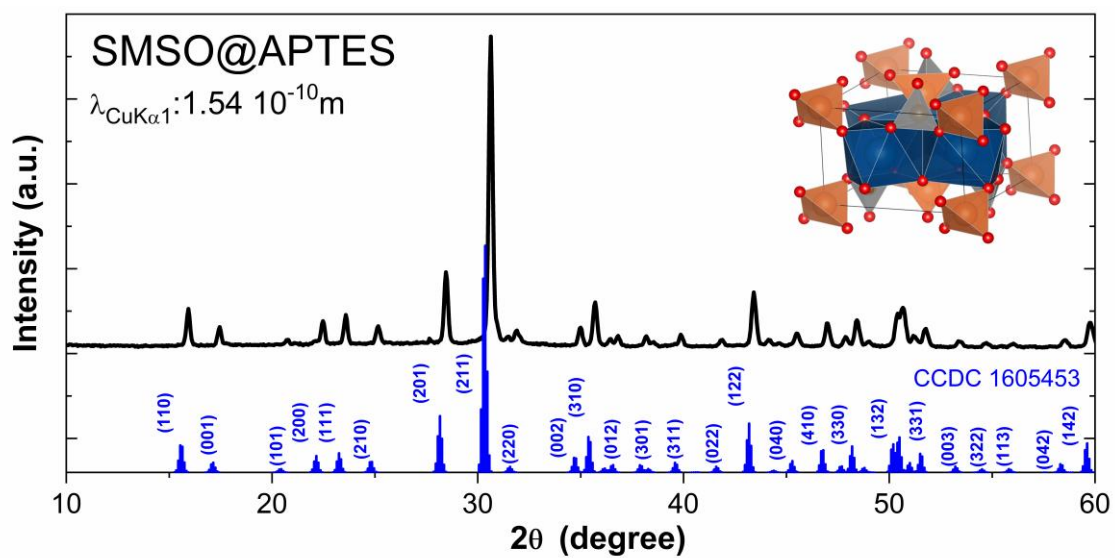


Figure S1: SMSO@APTES crystallography, CCDC 1605453 pattern as a reference for SMSO.

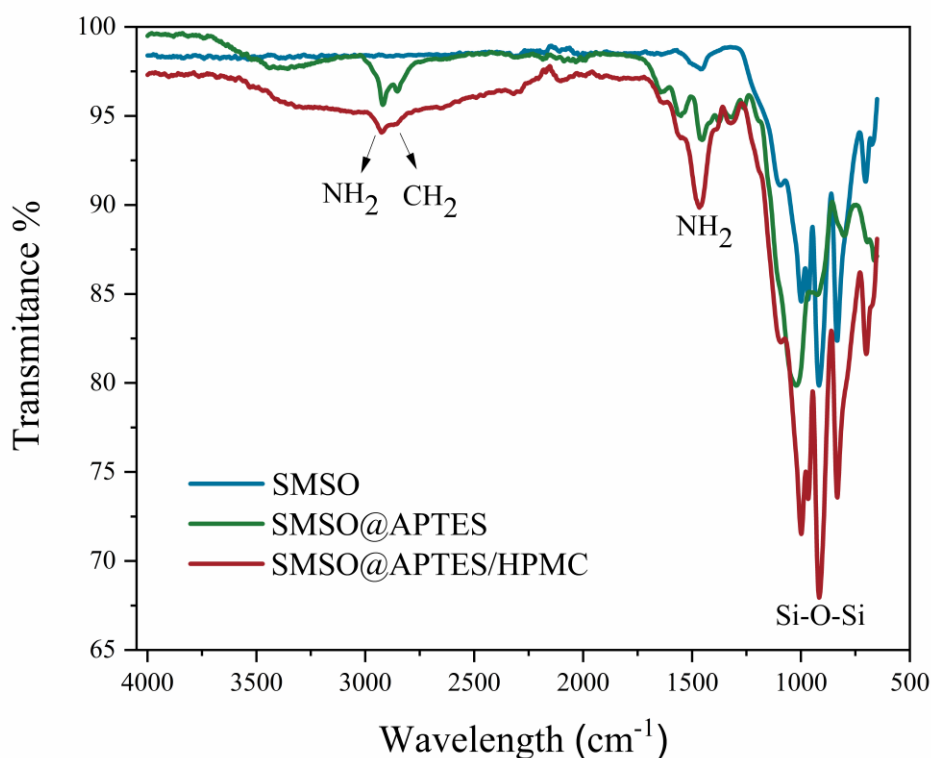


Figure S2: FTIR spectrum of SMSO NPs (blue), SMSO@APTES NPs (green) and Composite (red).

The FTIR spectra of the SMSO and the resulting composite are presented in the Figure S2. Intense bands ranging from  $550\text{ cm}^{-1}$  to  $983\text{ cm}^{-1}$  are assigned to Si-O vibrations:  $983\text{ cm}^{-1}$  band assigned to the Si-O-Si asymmetric stretch;  $835$  and  $693\text{ cm}^{-1}$  bands assigned to Si-O symmetric stretching. They are all present in the three spectra of SMSO, SMSO@APTES and SMSO@APTES/HPMC[16].

The presence of APTES forming a silica-like shell is evident by the presence of the vibrational modes related to  $\text{NH}_2$  and  $\text{CH}_2$  in the SMSO@APTES SMSO@APTES/HPMC spectra. The band at  $3400\text{ cm}^{-1}$  is attributed to the asymmetric stretching of  $\text{NH}_2$  in amines. The bands at  $2917\text{ cm}^{-1}$  and  $2837\text{ cm}^{-1}$  are assigned to stretching modes of  $\text{CH}_2$  at alkanes and the  $1562\text{ cm}^{-1}$  assigned to the N-H bending of the amine groups[15].

A more detailed analysis of the  $\text{Sr}_2\text{MgSi}_2\text{O}_7$  was made by Salim *et al.* and, based on their work, the majority of the bands of our material is presented in table S1.[14]

Table S1. Attribution of the main vibrational bands of SMSO, SMSO@APTES and SMSO@APTES/HPMC.

Attribution	Energy $cm^{-1}$
Si-O symmetric stretching	693
Si-O symmetric stretching	835
Si-O-Si asymmetric stretching	983
Sr-O-Si bending	1460
N-H bending	1549
Mg-O-Si stretching	1640
C-H stretching alkane	2837
C-H stretching alkane	2917
N-H stretching	3417

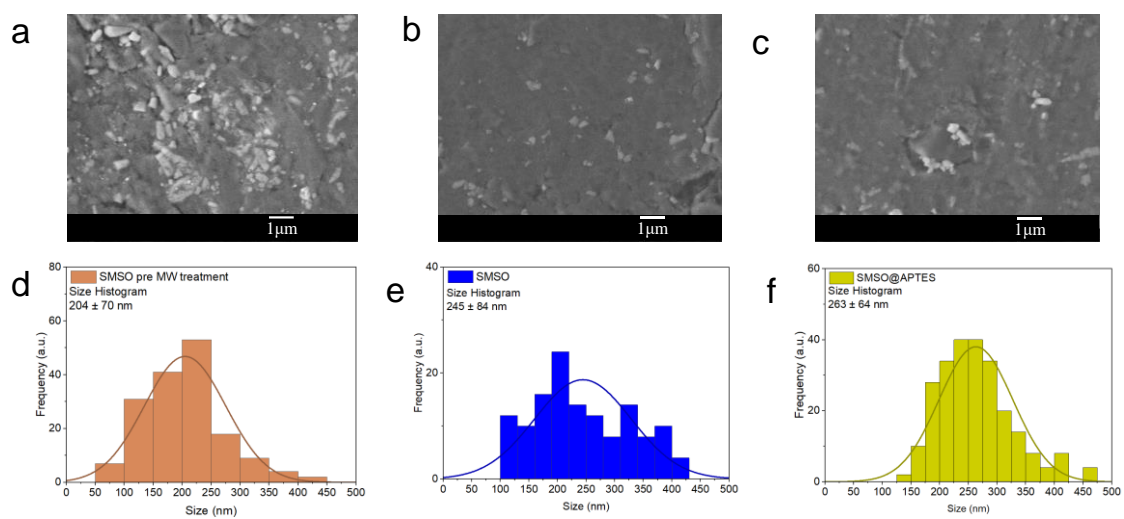
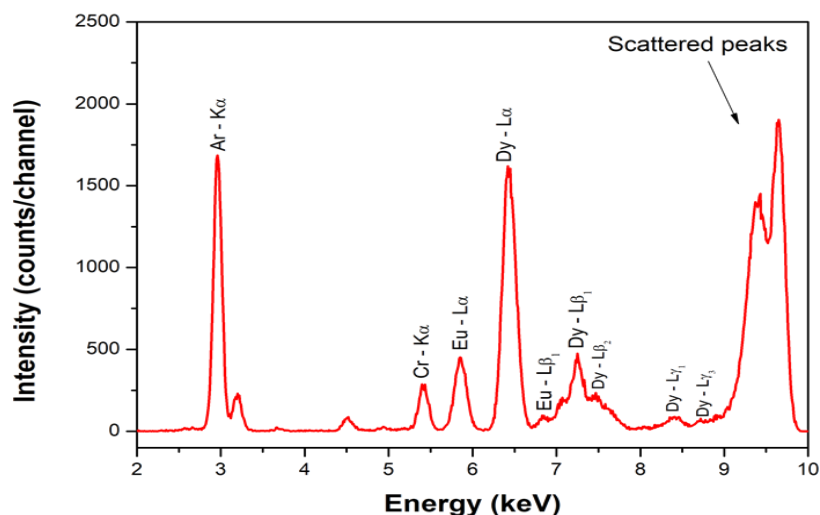
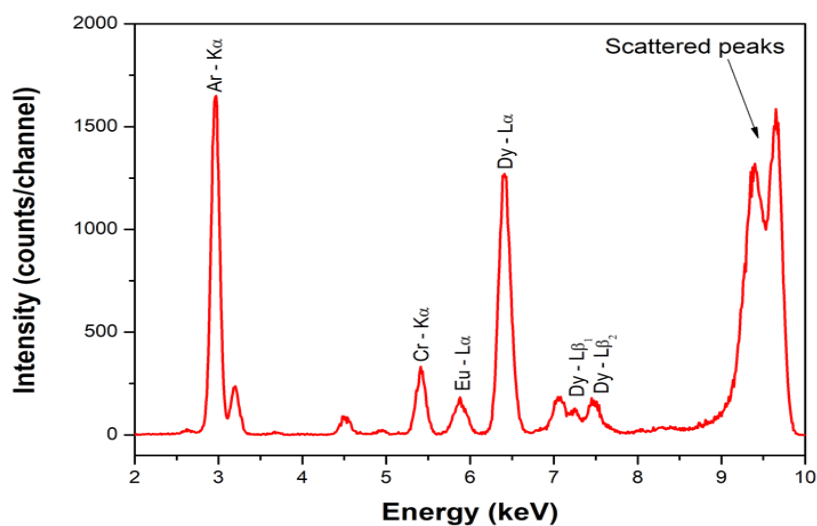


Figure S3: SEM images of (a) SMSO pre microwave (MW) treatment (precursor), (b) SMSO after MW treatment, and (c) of SMSO@APTES; Size histogram for of (d) SMSO pre MW treatment (precursor), (e) SMSO after MW treatment, and (f) of SMSO@APTES.

SMSO@APTES/HPMC –  $1\text{ g m}^{-2}$



SMSO@APTES/HPMC –  $10\text{ g m}^{-2}$



SMSO@APTES/HPMC –  $100\text{ g m}^{-2}$

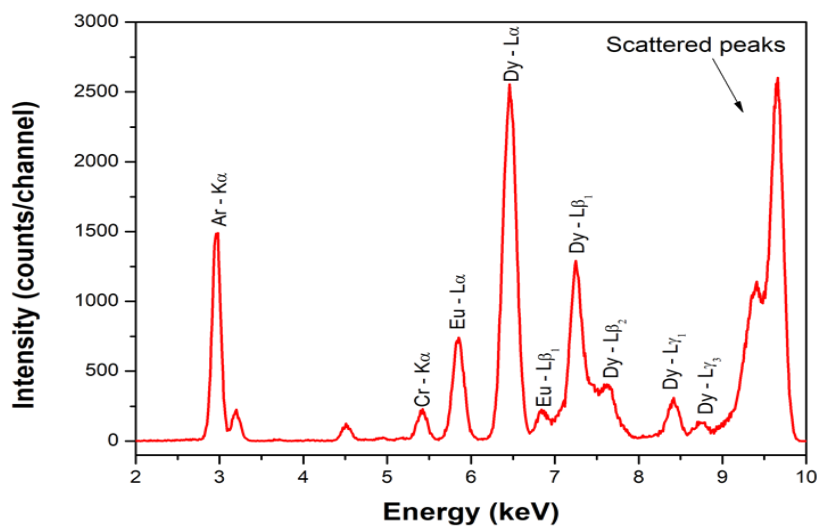


Figure S4: XRF spectra for SMSO@APTES/HPMC (a)  $1\text{ g m}^{-2}$ ; (b)  $10\text{ g m}^{-2}$  and (c)  $100\text{ g m}^{-2}$

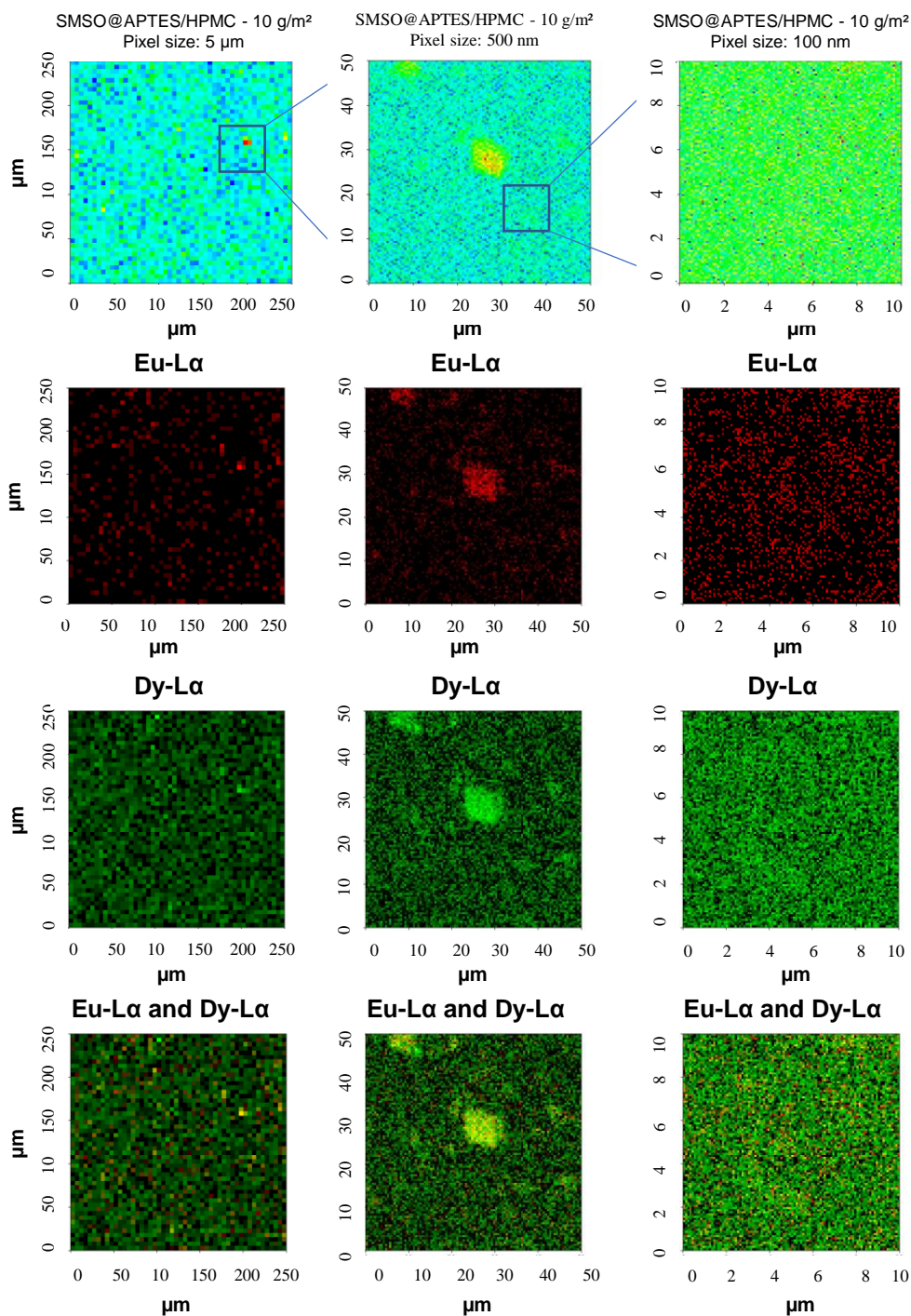


Figure S5: STXM images of SMSO@APTES/HPMC  $10 \text{ g}\cdot\text{m}^{-2}$  film at  $9.656 \text{ keV}$ . (b-d) XRF mapping of SMSO@APTES/HPMC  $10 \text{ g}\cdot\text{m}^{-2}$  film at (b) Eu  $L\alpha$  ( $5.845 \text{ keV}$ ); (c) Dy  $L\alpha$  ( $6.495 \text{ keV}$ ); (d) Eu and Dy  $L\alpha$  lines under  $9.656 \text{ keV}$  excitation.

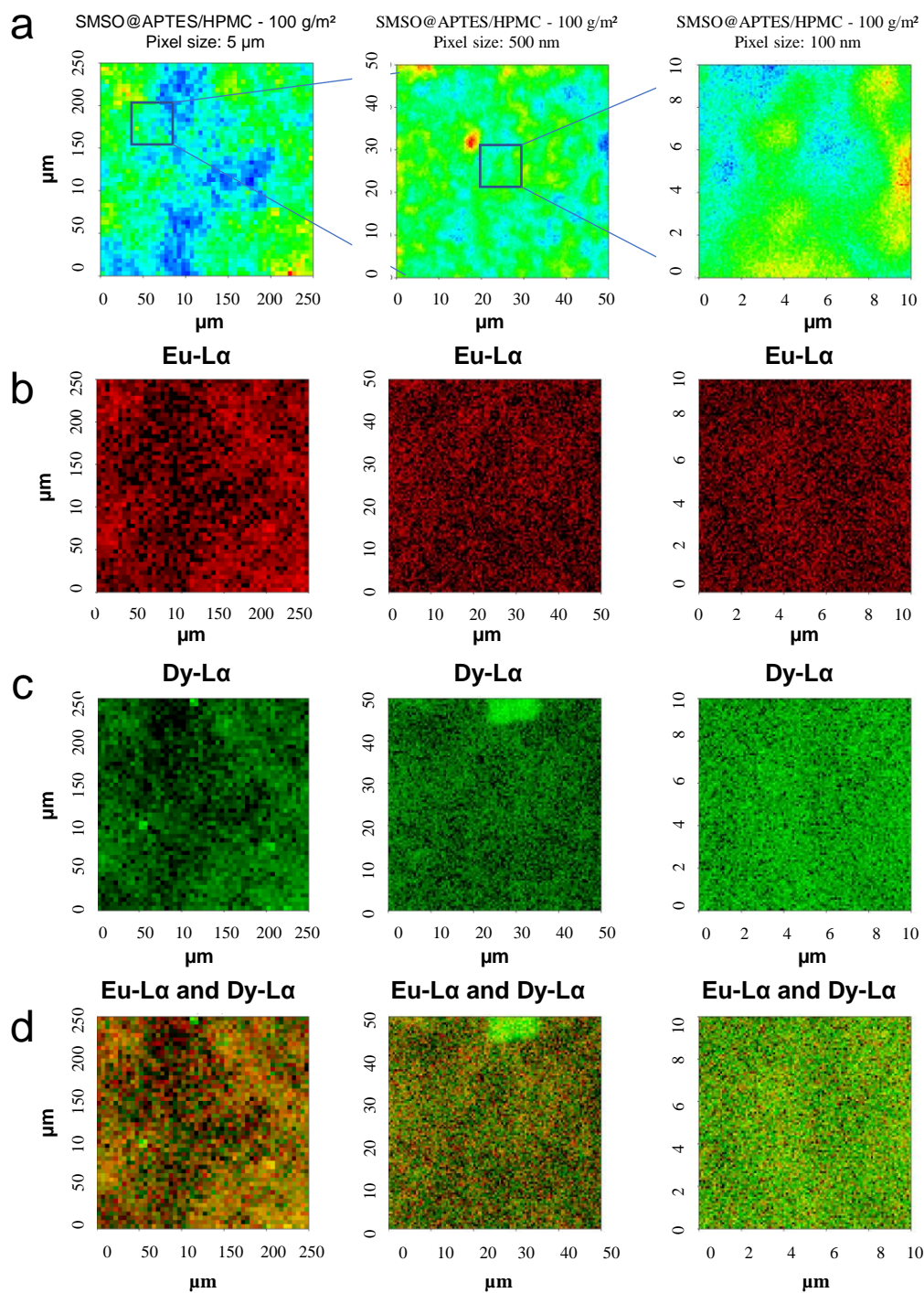


Figure S6: STXM images of SMSO@APTES/HPMC 100 g/m<sup>2</sup> film at 9.656 keV. (b-d) XRF mapping of SMSO@APTES/HPMC 100 g m<sup>-2</sup> film at (b) Eu Lα (5.845 keV); (c) Dy Lα (6.495 keV); (d) Eu and Dy Lα lines under 9.656 keV excitation.



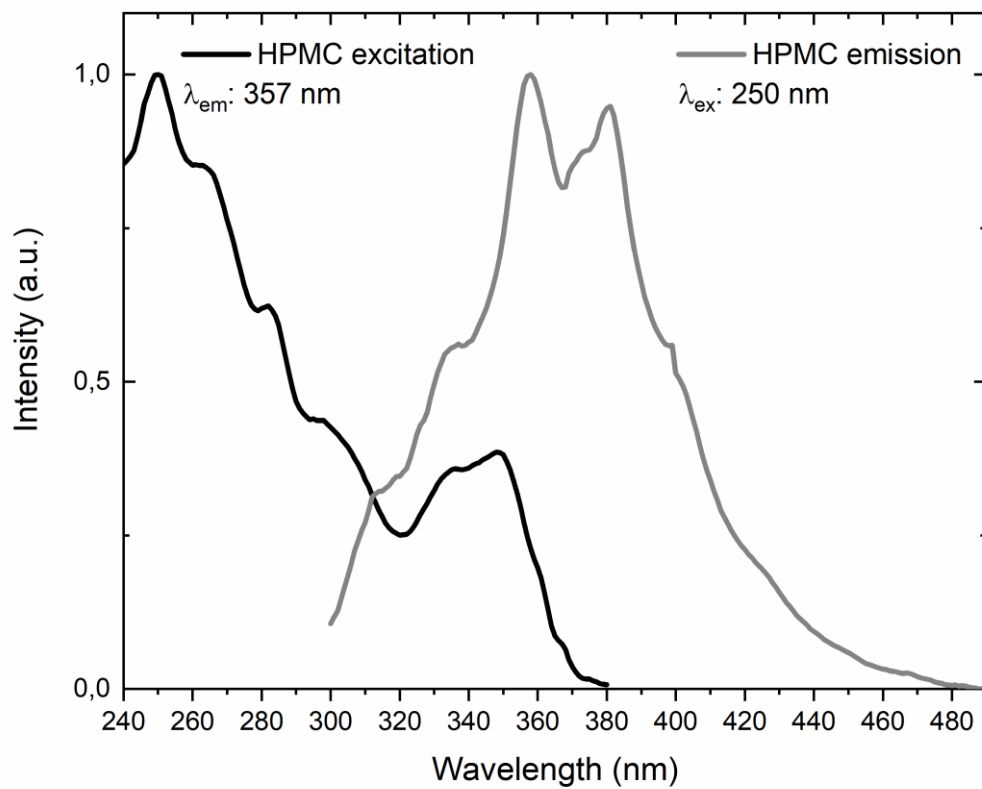


Figure S6: Excitation spectrum of HPMC measurement performed at room temperature, fixed excitation scan at 357 nm (black line) emission spectra of HPMC measurement performed at room temperature, fixed emission scan at 250 nm (gray line).

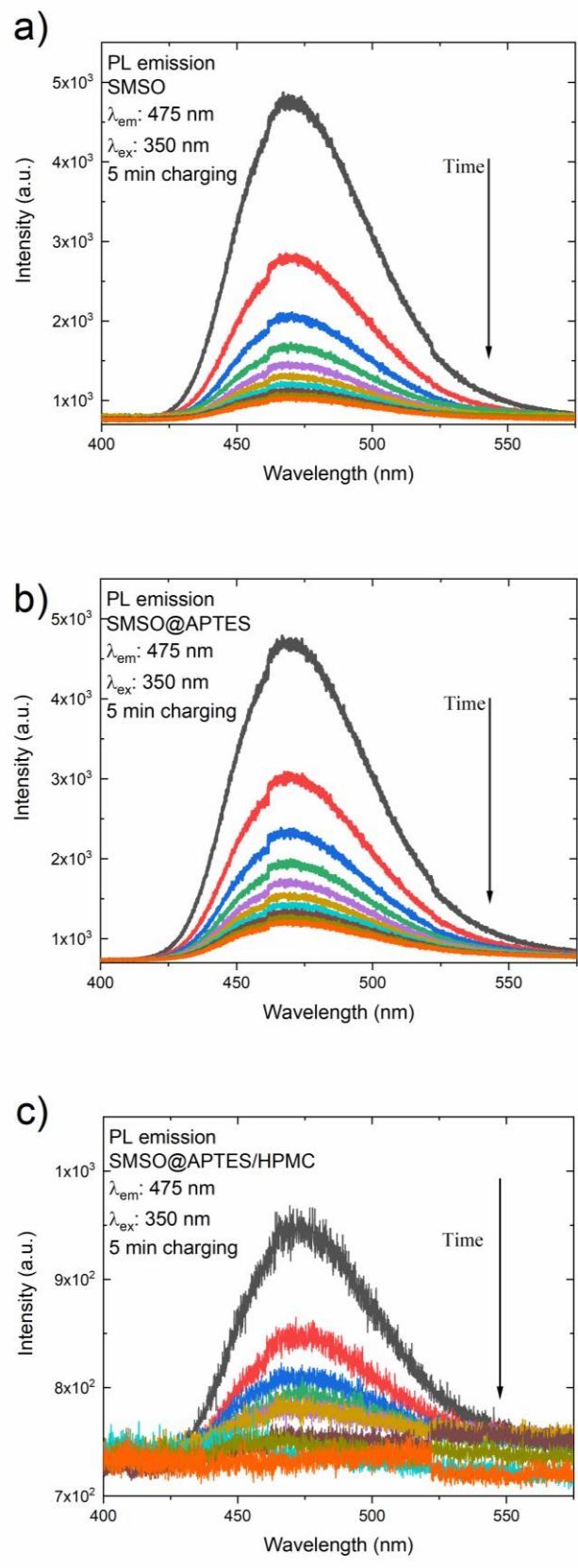


Figure S8: PL Emission Spectra of (a) SMSO, (b) SMSO@APTES, and (c) SMSO@APTES/HPMC with concentration of  $10 \text{ g m}^{-2}$ , monitored at 475 nm, after 5 min charging at 350 nm. Measurements with delay time of 1 min between measurements.

## Supplementary Material References

- [1] I. P. Sahu, D. P. Bisen, N. Brahme and R. K. Tamrakar, *J. Radiat. Res. Appl. Sci.*, 2015, **8**, 104–109.
- [2] S. Villa, P. Riani, F. Locardi and F. Canepa, *Mater. 2016, Vol. 9, Page 826*, 2016, **9**, 826.
- [3] M. A. Salim, R. Hussin, M. S. Abdullah, S. Abdullah, N. Shahira Alias, S. Aishah, A. Fuzi, M. Nor, M. Yusuf and K. M. Mahbor, *Solid State Sci. Technol.*, 2009, **17**, 59–64.