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

Investigation on sensitive SERS detection via Perovskite-coated Ag nanofilm

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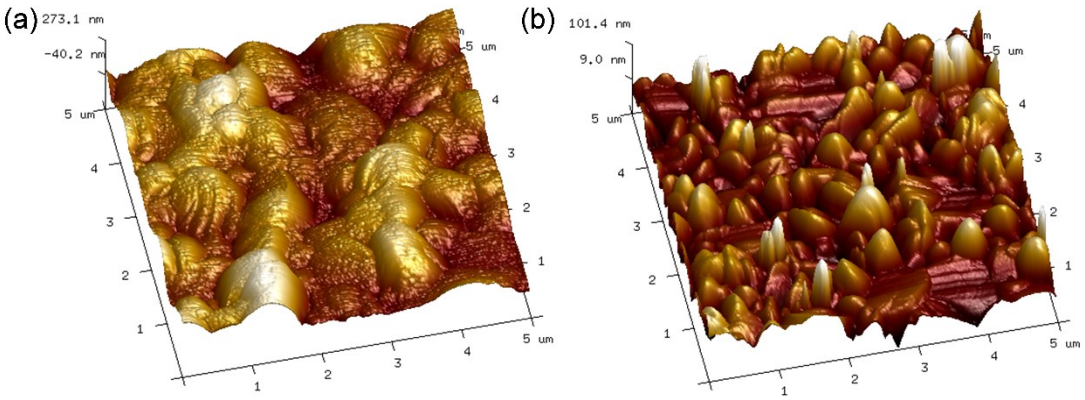

Figure S1. AFM three-dimensional views of $CsPbIBr_2$ films prepared on different substrates: (a) ITO-$CsPbIBr_2$, (b) ITO-Ag-$CsPbIBr_2$.

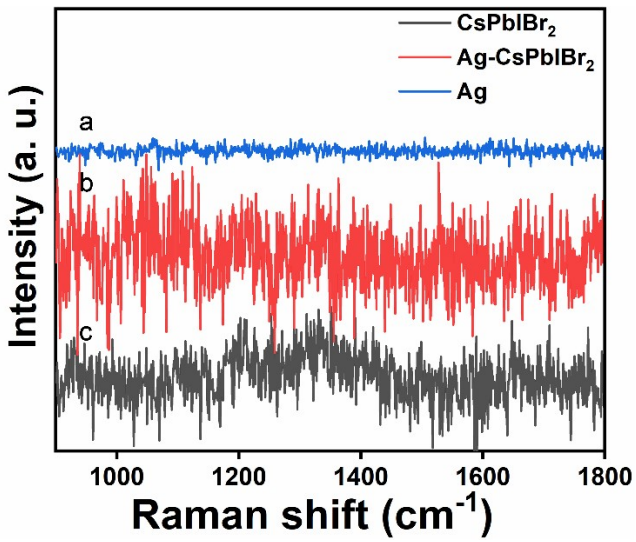

Figure S2. Raman spectra of Ag (a), Ag-$CsPbIBr_2$ (b), $CsPbIBr_2$(c).

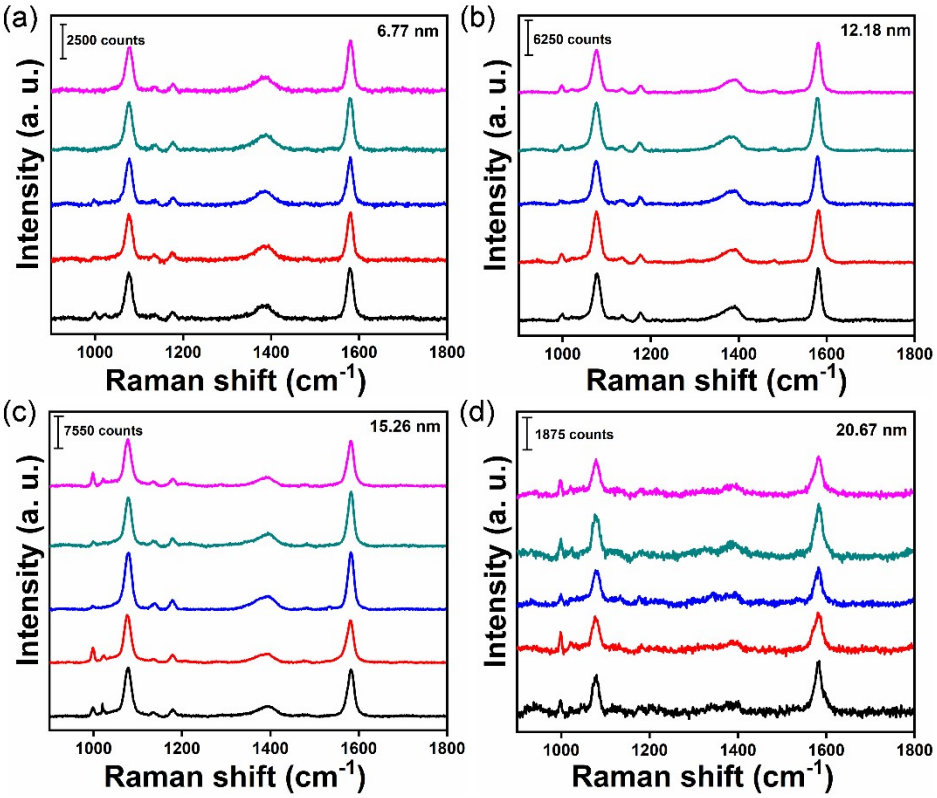

Figure S3. SERS spectra of five different positions on Ag-$CsPbIBr_2$ nanocomposite substrate modified by PMBA probe molecules prepared by silver nanofilms with different evaporation thicknesses.

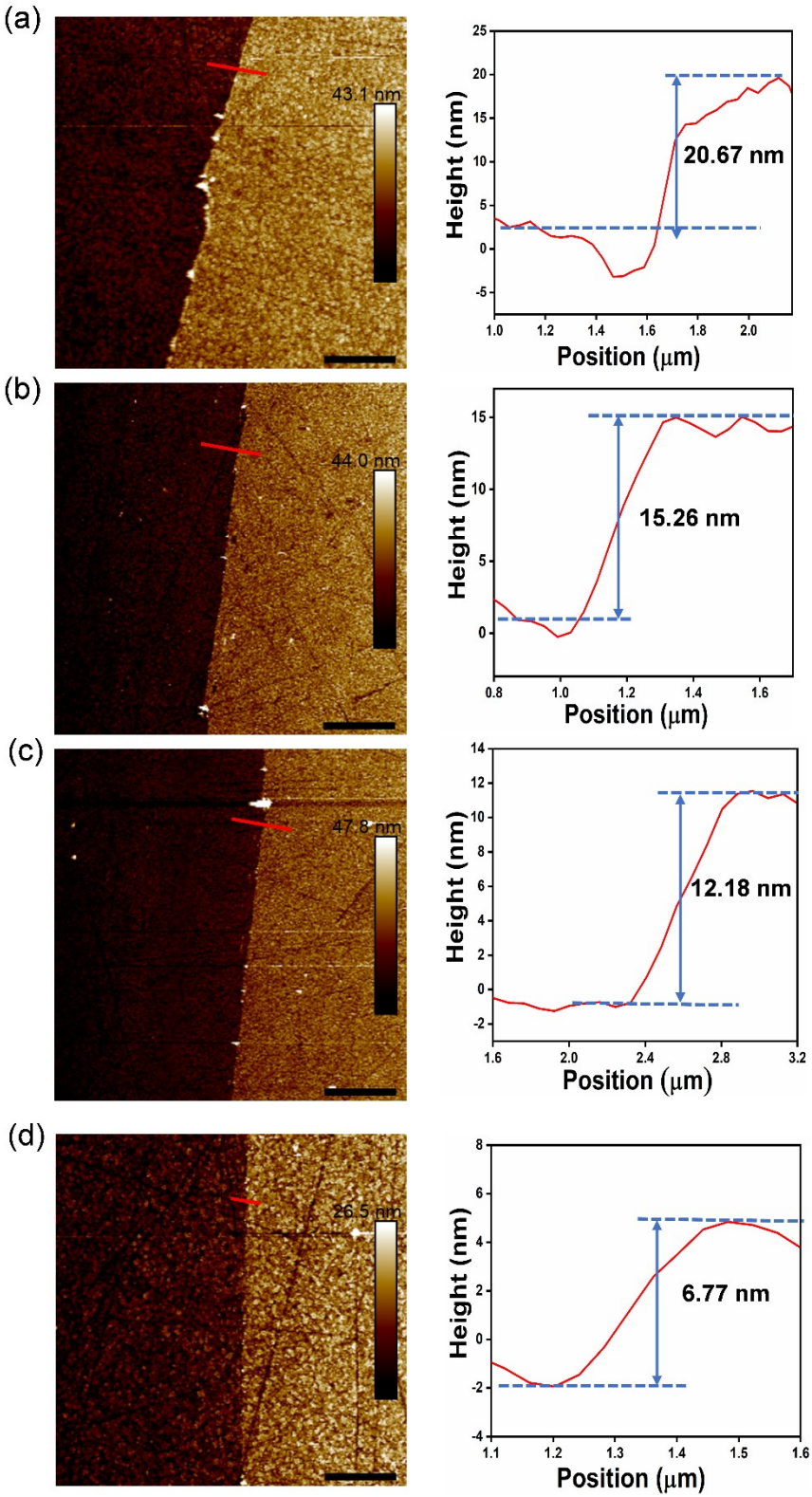

Figure S4. AFM images of Ag thin films with different thickness on a ITO substrate.

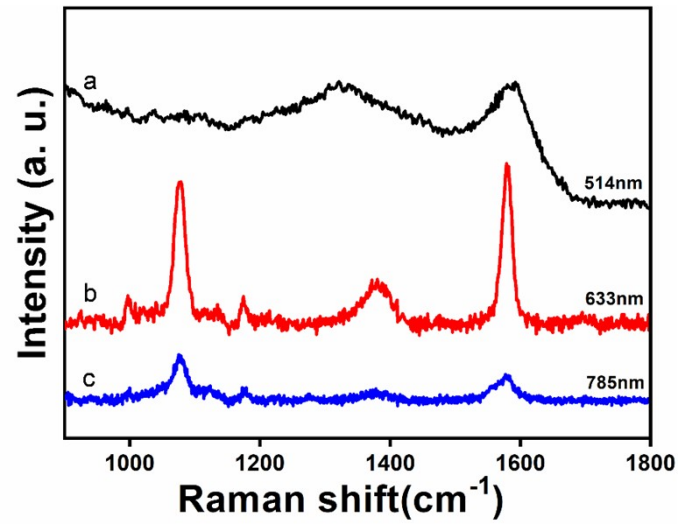

Figure S5. SERS spectra of PMBA probe molecules absorbed on Ag-$CsPbIBr_2$ composite substrate under excitations of 514 nm, 633 nm and 785 nm, respectively.

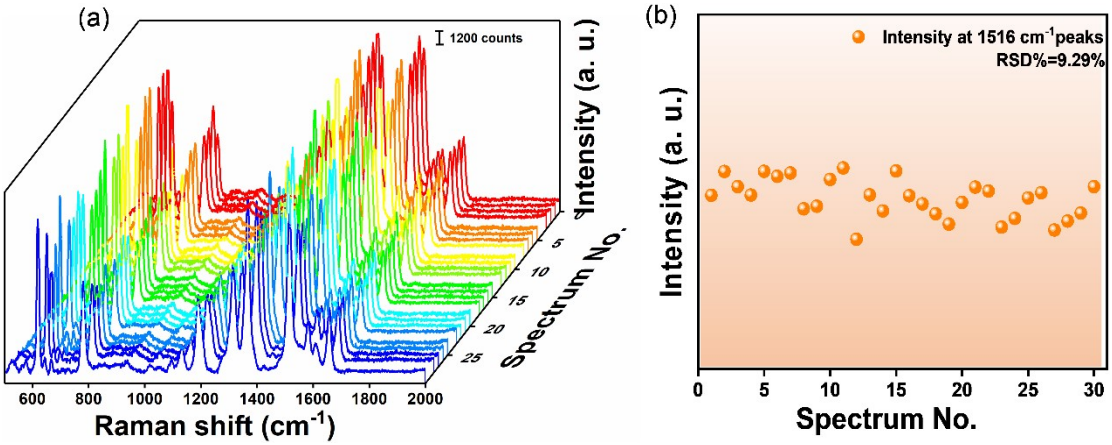

Figure S6. (a) Uniformity, (b) the corresponding intensity distributions at 1516cm^{-1} of R6G molecules in (a) of Ag-$CsPbIBr_2$ nanocomposite substrate.

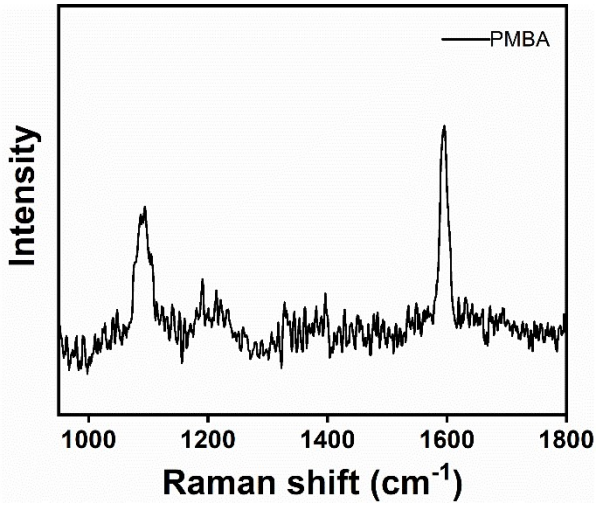

Figure S7. Measured Raman spectrum of bulk PMBA molecules.

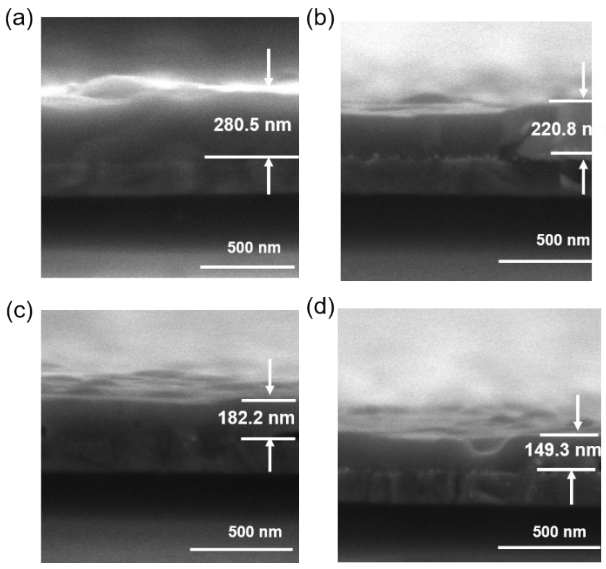

Figure S8. Cross-sectional SEM images of Ag-$CsPbIBr_2$ with different thickness.

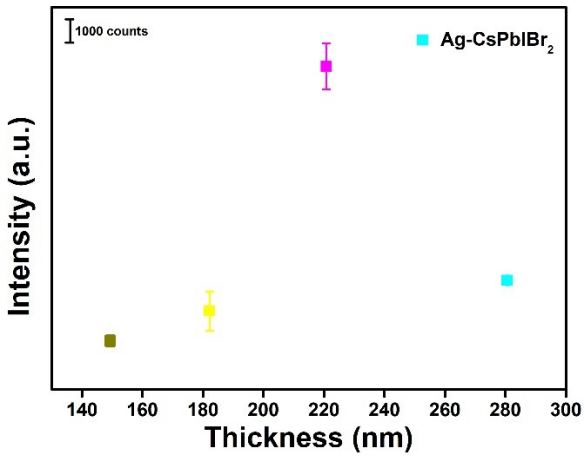

Figure S9. Perovskite thickness dependent SERS intensities of PMBA on Ag-CsPbIBr2 films collected from peak located at 1074 cm^{-1}. The error bars show the standard deviation from five different measurements.

Table S1. Fitting parameters of PL decay curves.

Substrate	τ_1/ns	A_1/%	τ_2/ns	A_2/%	$\tau_{average}$/ns
$CsPbIBr_2$	0.06	30.53	26.55	69.47	18.46
Ag-$CsPbIBr_2$	0.08	86.76	19.04	13.24	2.59

Table S2. Raman Peak Assignme.

Vibration mode assignments of PMBA[S1-S3]:

band assignment	PMBA /Ag-$CsPbIBr_2$ /cm^{-1}	PMBA/Ag/cm^{-1}	PMBA/cm^{-1}
in-plane ring breathing mode coupled with ν(C-S)	1074	1081	1080
aromatic ring ν(C-C) vibration mode	1582	1587	1590
C-H deformation mode	1135、1174	1132、1172	

[S1] L. Yang, X. Jiang, W. Ruan, B. Zhao, W. Xu and J. R. Lombardi, *The Journal of Physical Chemistry C*, 2008, **112**, 20095-20098.
[S2] X. Jiang, Y. Chen, J. Du, X. Li, Y. Shen, M. Yang, X. Han, L. Yang and B. Zhao, J Raman Spectrosc, 2018, **49**, 1257-1264.
[S3] L. Zhou, J. Zhou, W. Lai, X. Yang, J. Meng, L. Su, C. Gu, T. Jiang, E. Y. B. Pun, L. Shao, L. Petti, X. W. Sun, Z. Jia, Q. Li, J. Han and P. Mormile, Nat Commun, 2020, **11**, 1785.

Table S3. Raman Peak Assignme.
Vibration mode assignments of R6G[9,39]:

band assignment	R6G/cm^{-1}
C-C-C in-plane bending	617
ν(C-H) out-of-plane bend mode	778
ν(C-H) in-plane bend mode	1188
ν(N-H) in-plane bending mode	1314
ν(C-C) stretching mode	1367、1517、1658

[9] H. Z. Sun, S. Cong, Z. H. Zheng, Z. Wang, Z. G. Chen and Z. G. Zhao, *J Am Chem Soc*, 2019, **141**, 870-878.
[39] H. Yang, H. Hu, Z. Ni, C. K. Poh, C. Cong, J. Lin and T. Yu, Carbon, 2013, **62**, 422-429.