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

Lasing in perovskite crystallites grown via silver-nanowire-induced nucleation

Bin Liu, Junhan Guo, Yang Tang, Liang Qin*, Zhidong Lou, Yufeng Hu, Feng Teng and Yanbing Hou*

Key Laboratory of Luminescence and Optical Information Ministry of Education

Beijing JiaoTong University

Beijing 100044, P. R. China.

E-mail address: qinliang@bjtu.edu.cn; ybhou@bjtu.edu.cn

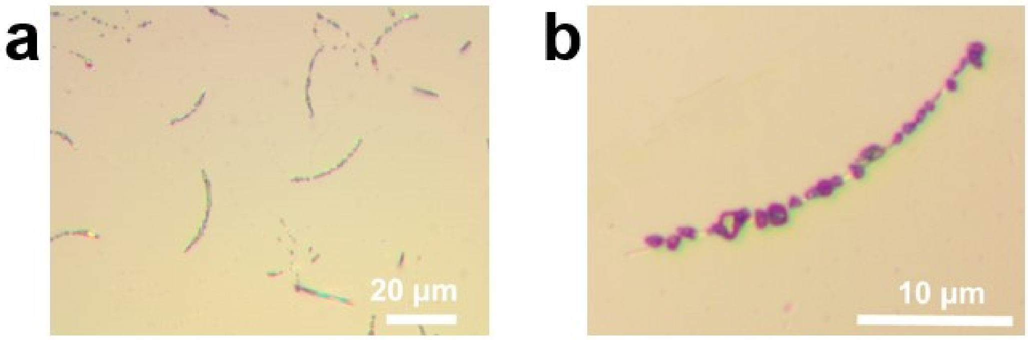


Figure S1. (a) and (b) Microscopy photographs of $MAPbBr_3$ crystallites grown on primary Ag nanowires.

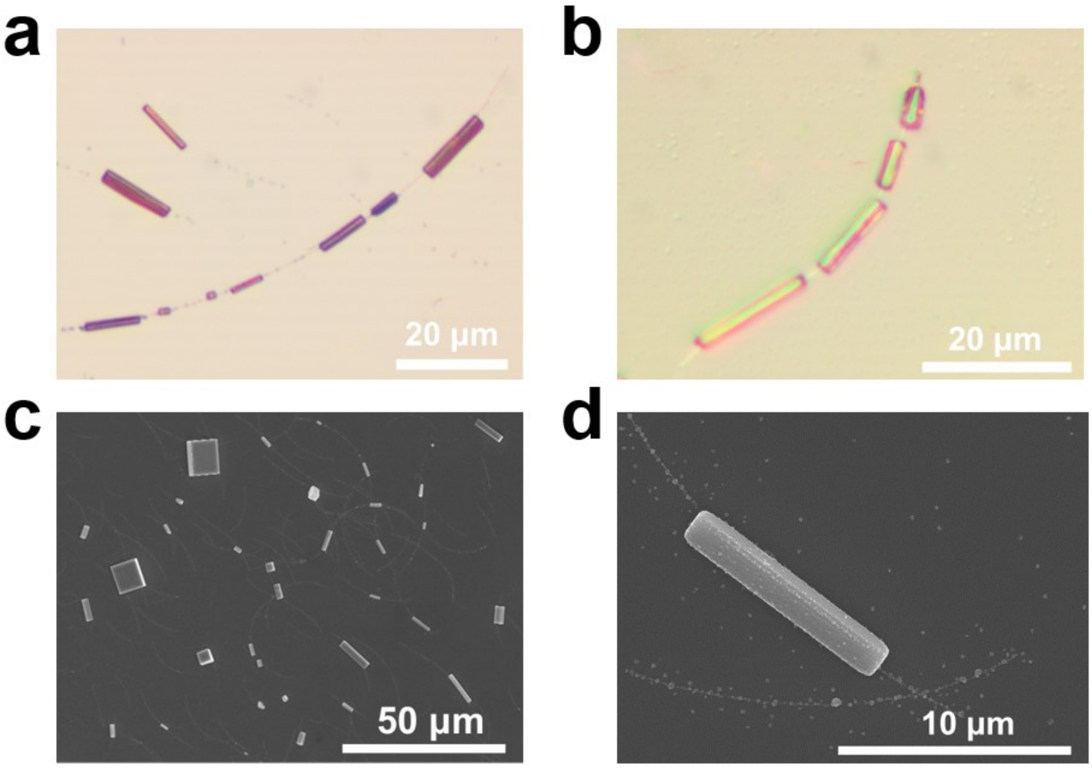


Figure S2. Microscopy photographs (a, b) and SEM images (c, d) of $MAPbBr_3$ crystallites with large aspect ratios. $MAPbBr_3$ crystallites grown on silver nanowires with diameters of 60 nm (a, c) and 90 nm (b, d), respectively.

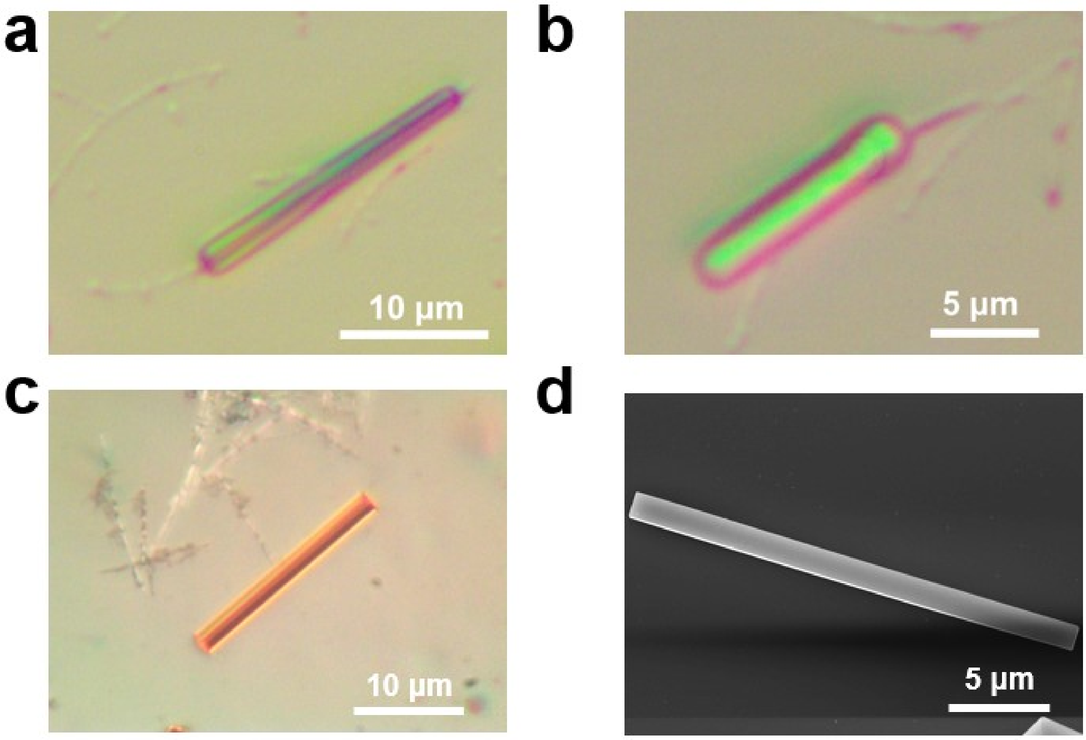


Figure S3. Microscopy photographs (a-c) and SEM image (d) of $MAPbBr_3$ rod-shaped crystallite grown on silver nanowires with diameters of 30 nm and 120 nm.

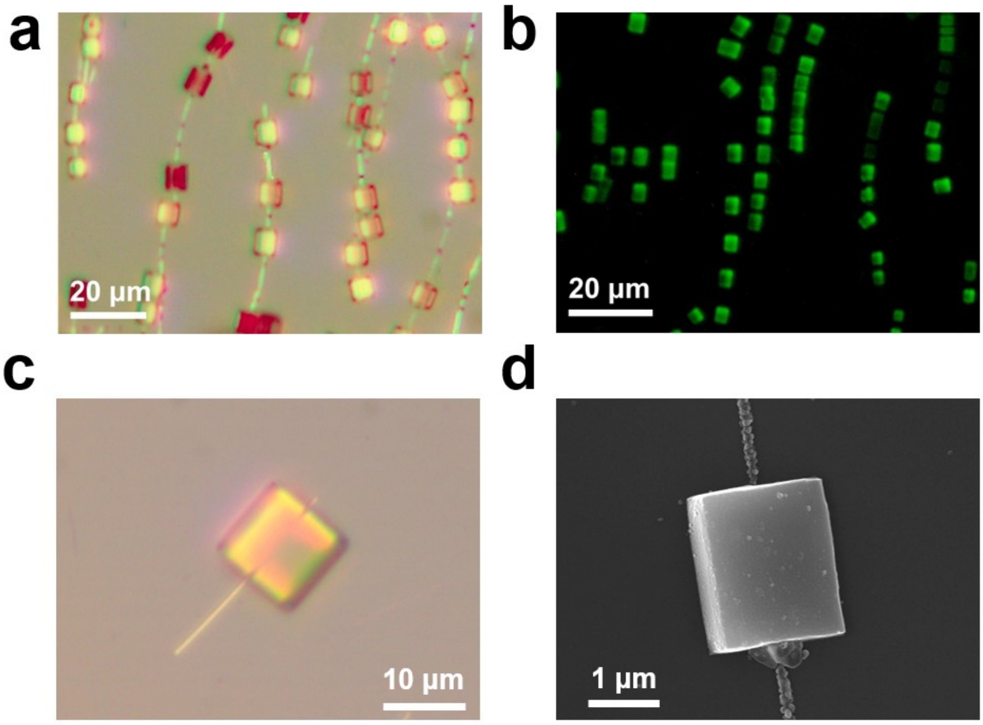
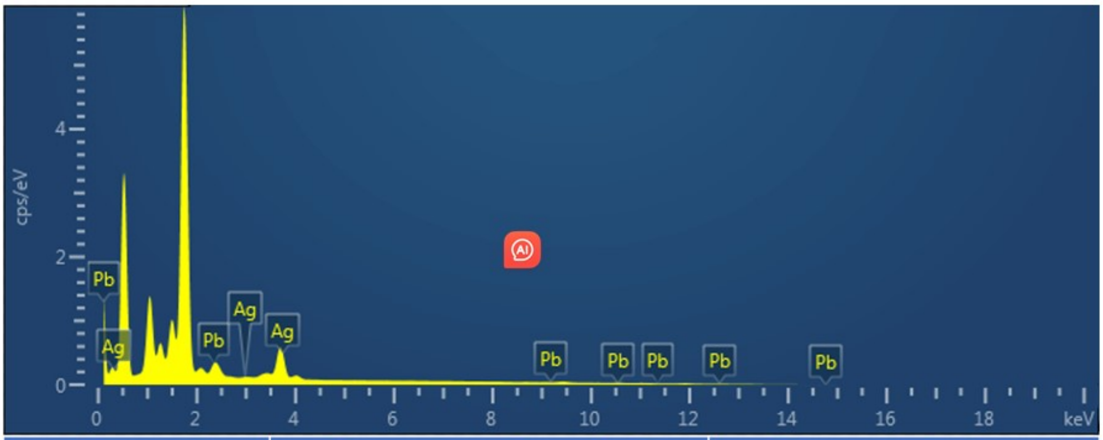


Figure S4. Microscopy photographs (a) and fluorescence microscopy images (b) of $MAPbBr_3$ crystallites with aspect ratio of about 1 (The concentration of precursor solution is 0.01 mmol/ml). Microscopy photograph (c) and SEM image (d) of single square $MAPbBr_3$ crystal.



Element	Percentage by weight	Percent of atoms
Ag	2.87	2.81
Br	58.54	77.48
Pb	38.59	19.70

Figure S5. Element distribution of $MAPbBr_3$ crystal in **Figure S4d**.

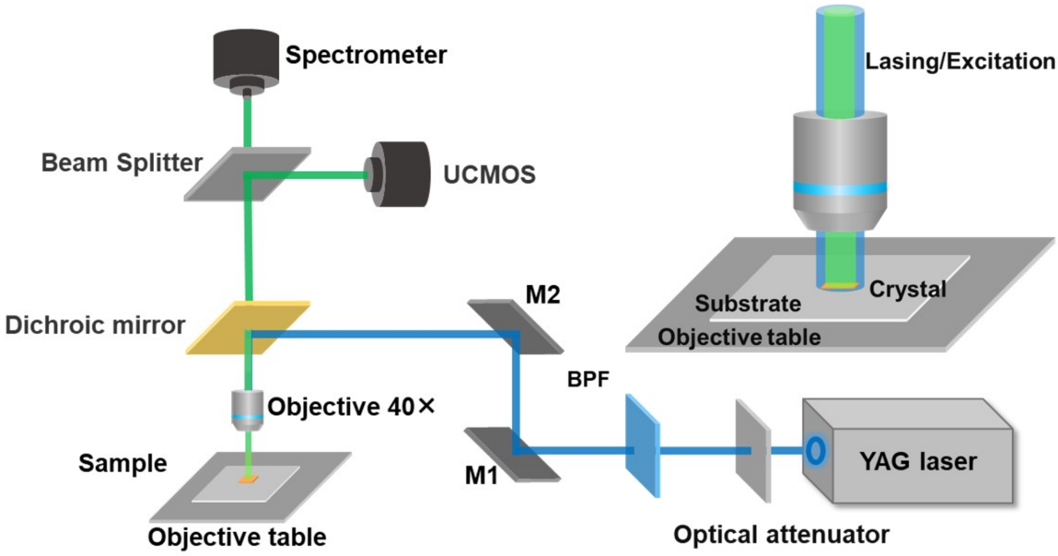


Figure S6. The schematic diagram for laser performance test of $MAPbBr_3$ crystallites.

Table S1. Laser thresholds of perovskite materials under different Pump pulse lengths

Active Material	Threshold	Pump Pulse Length	Reference
$FAPbI_3$	3 μJ cm^{-2}	150 fs	[1]
$FAPbI_3$	19.5 μJ cm^{-2}	5 ns	[1]
$MAPbI_3$	12 μJ cm^{-2}	150 fs	[2]
$MAPbI_3$	54.1 μJ cm^{-2}	5 ns	[3]
$CsPbBr_3$	3.3 μJ cm^{-2}	150 fs	[4]
$CsPbBr_3$	64.9 μJ cm^{-2}	5.5 ns	[4]
$MAPbBr_3$	15 μJ cm^{-2}	80 fs	[5]
$MAPbBr_3$	14 μJ cm^{-2}	5 ns	this work

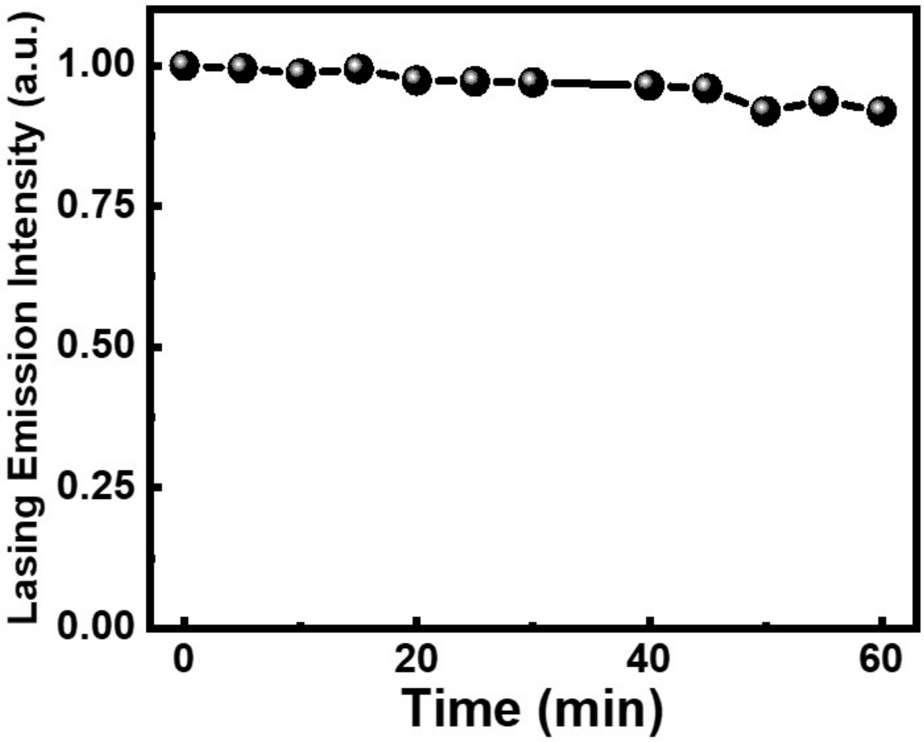


Figure S7. The stability of $MAPbBr_3$ crystallite under the continuous irradiation of a 450 nm pulsed laser (5 ns, 10 Hz) in air.

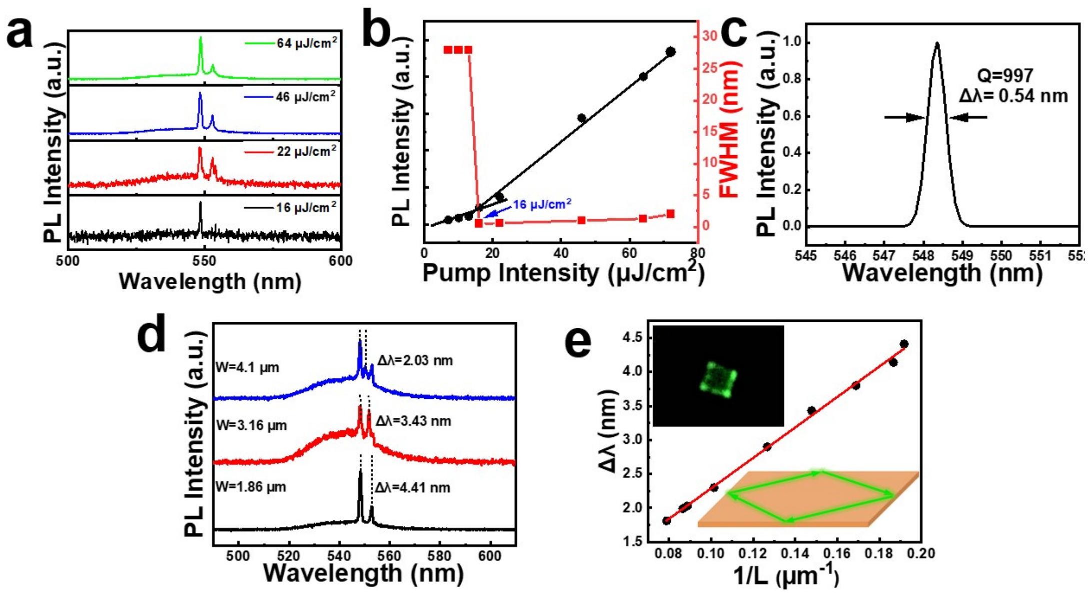


Figure S8 (a) Pump intensity-dependent PL spectra of a $MAPbBr_3$ square crystallite embedded with silver nanowires excited at 450 nm (10 Hz, 5 ns); (b) PL intensity and FWHM as functions of pump intensity; (c) Gaussian fitting of a lasing peak at 548 nm, giving an FWHM of 0.54 nm, corresponding to a Q factor of 997. (d) The spacing $\Delta\lambda$ between the two modes is calculated and plotted as a function of the reciprocal of the total internal reflection path L ($L=2\sqrt{2}W$).

References

1. F. Yuan, Z. Wu, H. Dong, J. Xi, K. Xi, G. Divitini, B. Jiao, X. Hou, S. Wang and Q. Gong, *The Journal of Physical Chemistry C*, 2017, **121**, 15318-15325.
2. G. Xing, N. Mathews, S. S. Lim, N. Yantara, X. Liu, D. Sabba, M. Gratzel, S. Mhaisalkar and T. C. Sum, *Nat Mater*, 2014, **13**, 476-480.
3. L. Qin, L. Lv, Y. Ning, C. Li, Q. Lu, L. Zhu, Y. Hu, Z. Lou, F. Teng and Y. Hou, *RSC Advances*, 2015, **5**, 103674-103679.
4. L. Zhang, F. Yuan, H. Dong, B. Jiao, W. Zhang, X. Hou, S. Wang, Q. Gong and Z. Wu, *ACS Applied Materials & Interfaces*, 2018, **10**, 40661-40671.
5. S. Zhang, Q. Shang, W. Du, J. Shi, Z. Wu, Y. Mi, J. Chen, F. Liu, Y. Li, M. Liu, Q. Zhang and X. Liu, *Advanced Optical Materials*, 2017, **6**.