Supplementary Information

Linearly Polarized AC-Driven Perovskite Light Emitting Device with Nanoscale Metal Contact

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Section S1: Light Emission Mechanism of the device

When bias switch from negative to positive, the suddenly potential drop will cause conduction band bending and release photons. In this process, the recombination of carriers occurs in the interface between Ag contact and substrate, and the carriers near this area release more photons because of the strongest electric field, as shown in (a), and the emission image are shown as (b), we can confirm the area which has strong emission will occur near the contact, and the emission area in length is about 1.5-1.7 μm.

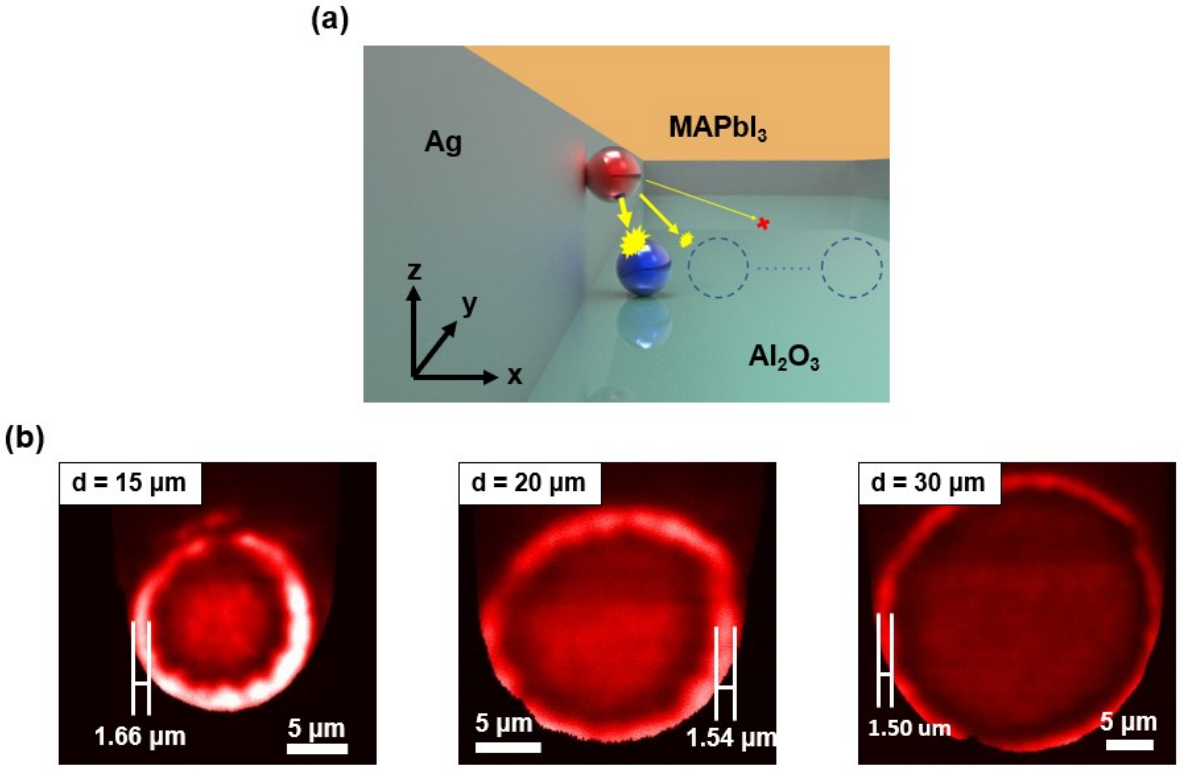

Figure S1. (a)Schematic diagram of the light-emitting mechanism of the device and (b)the emission images taken by EMCCD under different hollow electrode sizes shown in the inset of the images.

Section S2: Electric Field Distribution of the grating on the device

The calculated electric field profiles with finite-element method are shown in Figure S2(a). It indicated that the electric field exhibits strong resonance when excited in the TE mode, and it is primarily located at the top of the silver grating inside the $MAPbI_3$, which is consistent with the description in the text. In contrast, when excited in the TM mode, the resonance of the electric field mainly occurs at the interface between the silver grating and Al_2O_3, and it does not provide significant field enhancement for $MAPbI_3$. Figure S2(b) is the fitting result of the figure 3 (c), shows the Q-value of these four peaks, and we can observe $MAPbI_3$ will be mainly enhanced by the EXT(TE) and LPB(TE) according to the result in figure 3.

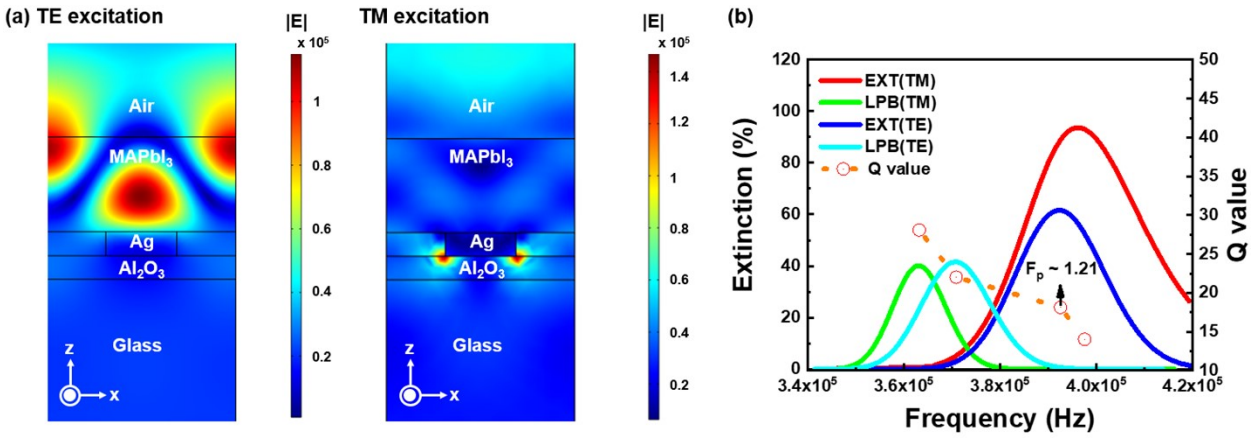

Figure S2. (a) TE and TM Electric field distribution map of the grating with p = 400 nm and w = 150 nm at a wavelength of 780 nm. (b) The distribution spectrum of the extinction peaks in the frequency domain along with the calculated Q factor for each peak.

Section S3: SEM image of the device surface and cross section

We can observe the $MAPbI_3$ film deposited on the Ag grating well and forms air gaps in the structure.

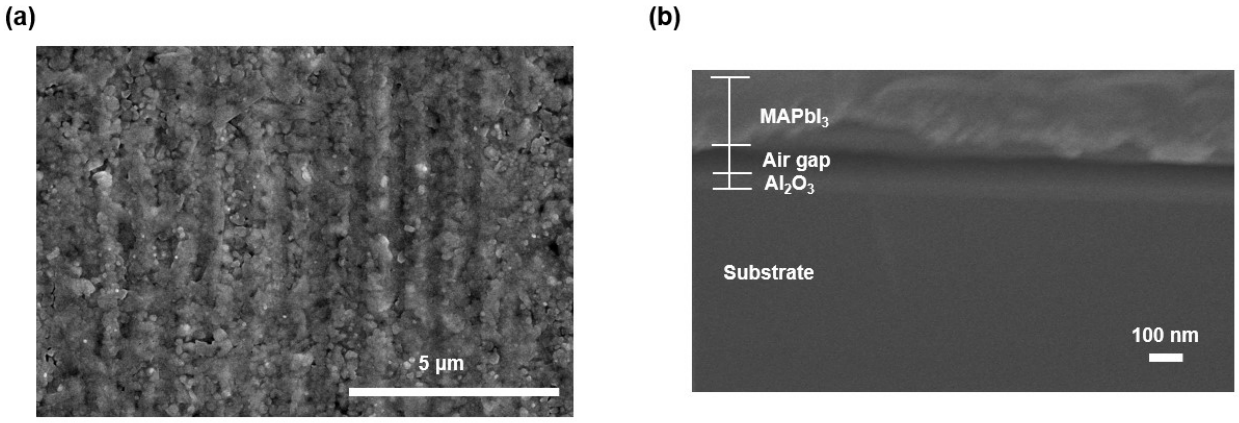

Figure S3. SEM image of the (a)top and (b)cross section $MAPbI_3$ with Ag grating.