

Support Information

Fig. S1. The refractive index and extinction coefficient of (a)Ag: Cu; (b) ITO; (c) Al_2O_3 ; (d) ZnO.



Fig. S2. UPS results of Ag and filter electrode.

Table S1. Crossover experiments of the thickness of Al_2O_3 and ZnO. In each figure, the curve with lower transmittance at the cental wavelength represents the F-P cavity without ZnO, while the other curve corresponds to the cavity with both Al_2O_3 and ZnO layers. Center wavelength and transmittance in parentheses.

	Al ₂ O ₃ 20 min	Al ₂ O ₃ 30 min	Al ₂ O ₃ 40 min	Al ₂ O ₃ 50 min
ZnO 20 min	No1:(692.7, 65.2 %)	No5:(688.5, 65.1%)	No9:(682.8, 71.7%)	No13:(677.0 ,70.8%)
	(0) 00000000000000000000000000000000000	(b) 000000000000000000000000000000000000	400 400 400 400 400 400 400 400	40 40 50 50 50 50 50 50 50 50 50 5
ZnO 30 min	No2:(683.5, 73.1%)	No6:(686.8, 71.9%)	No10:(669.7, 75.0%)	No14:(664.9, 75.1%)
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ZnO 40 min	No3:(676.5, 71.9%)	No7:(673.4, 70.2%)	No11:(658.1 ,76.6%)	No15:(654.5, 76.5%)
	00 00 00 00 00 00 00 00 00 00 00 00 00	Horizon (1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 1, 2, 2, 2, 1, 1, 1, 2, 2, 2, 1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	400 400 400 400 400 400 400 400	400 000 000 000 000 000 000 000
ZnO 50 min	No4:(680.0, 60.0%)	No8:(680.2, 60.0%)	No12:(663.0,67.9%)	No16:(659.5, 68.3%)
	Particular (100000) Particular (100000) Particula	Line (m)	Participant (mm)	Participant (100) Participant (



Fig. S3. *J-V* characteristic curve of the device using bare Fabry–Pérot cavity act as the electrode.

It is observed that the device incorporating Ag:Cu cavity electrodes exhibits a lower dark current density of 1.05×10^{-7} A/cm²at 0.5 V, compared to 3.1×10^{-6} A/cm²in the control device using ITO electrodes. This improvement is attributed to the lower work function of Ag: Cu, which suppresses hole injection under forward bias, thereby reducing dark current. Additionally, the open-circuit voltage (Voc) of the Ag: Cubased device improves from 0.2 V (ITO) to 0.32 V, indicating an enhancement in electrical performance due to the electrode design.



Fig. S4. The frequency response of filter electrode device at 0.5 V and under 650 nm.