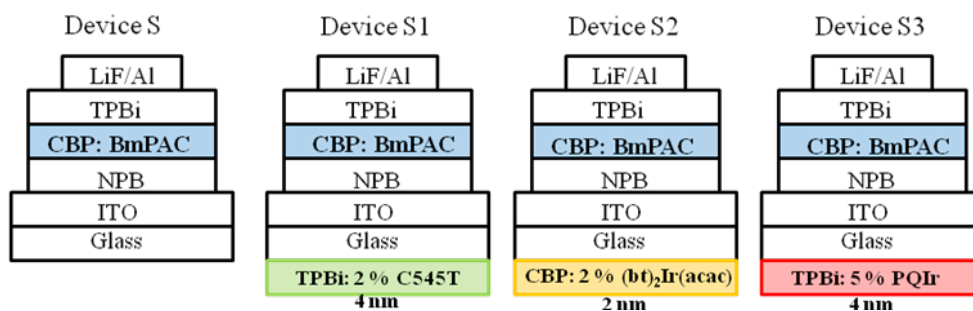


Supplementary Information

We have designed a set of supplementary devices to consider the internal absorption of emitted light in Device 3. First we have fabricated a typical OLED with same blue EL emission to that in manuscript: ITO/NPB (40 nm)/CBP: 2 wt % BmPAC (20 nm)/TPBi (25 nm)/ LiF (0.3 nm)/Al (150 nm), we name this device as Device S. After that, green, orange and red emitting layers of Device 3 with the same dopant concentration and thickness were deposited on the bottom side of glass substrate of Device S respectively, as sketched below.



These four devices were operated at a same current density to observe the luminescence of each device. We have obtained completely consistent spectra (see the figure below) which only include blue peak and almost same brightness among four comparative devices. We did not observe any green, orange, or red emission in Devices S1, S2, or S3. We drove all of the OLEDs at a constant current density of 29.8 mA/cm², a luminance of 1000 cd/m² was obtained in Device S, and this value changed to be 995, 996, and 993 cd/m² in Devices S1, S2, and S3. So we can deduce that the absorption loss of green, orange and red emitting layers is very small in the Device 3. We attribute this insignificant absorption to the low concentrations of dopants and the very thin doped emitting layers rather than neat thin films.

