

Extended Data

Operational stability enhancement in organic light emitting diodes with ultrathin Liq interlayers

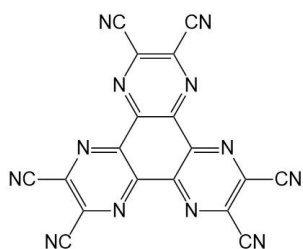
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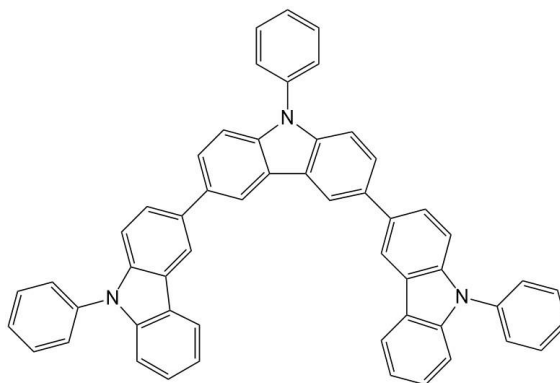
Nishi, Fukuoka 819-0395, Japan

²JST, ERATO, Adachi Molecular Exciton Engineering Project, Kyushu University, 744 Motooka, Nishi,

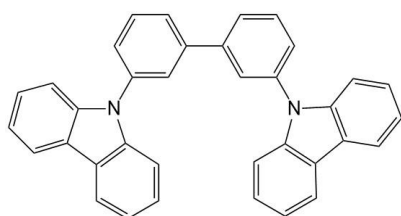
Fukuoka 819-0395, Japan



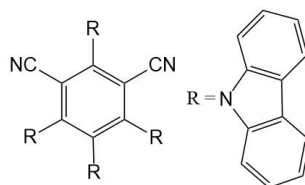
HAT-CN



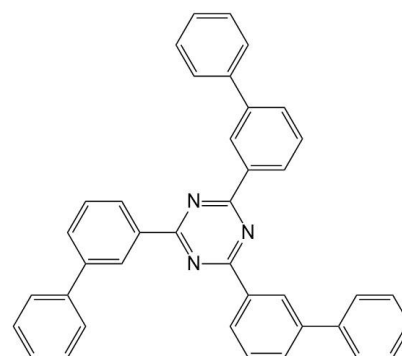
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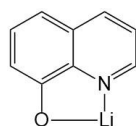
mCBP



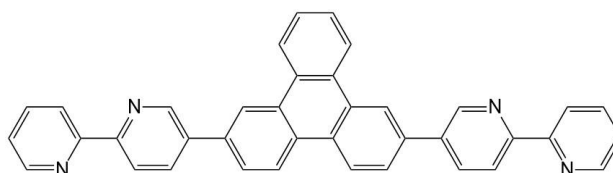
4CzIPN



T2T

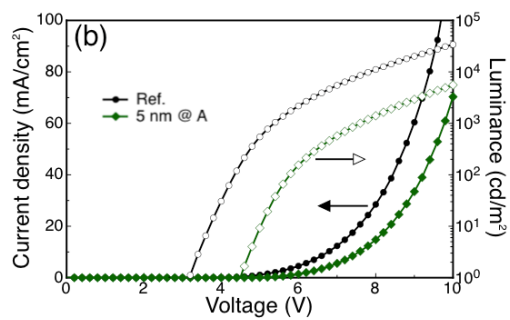
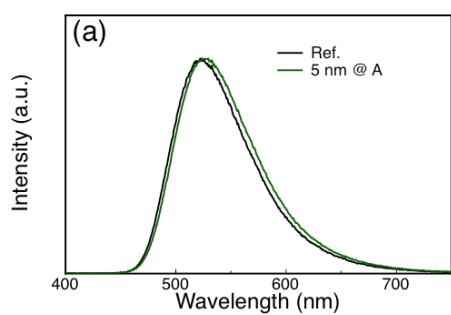


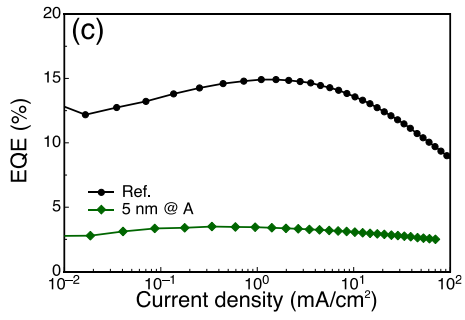
Liq



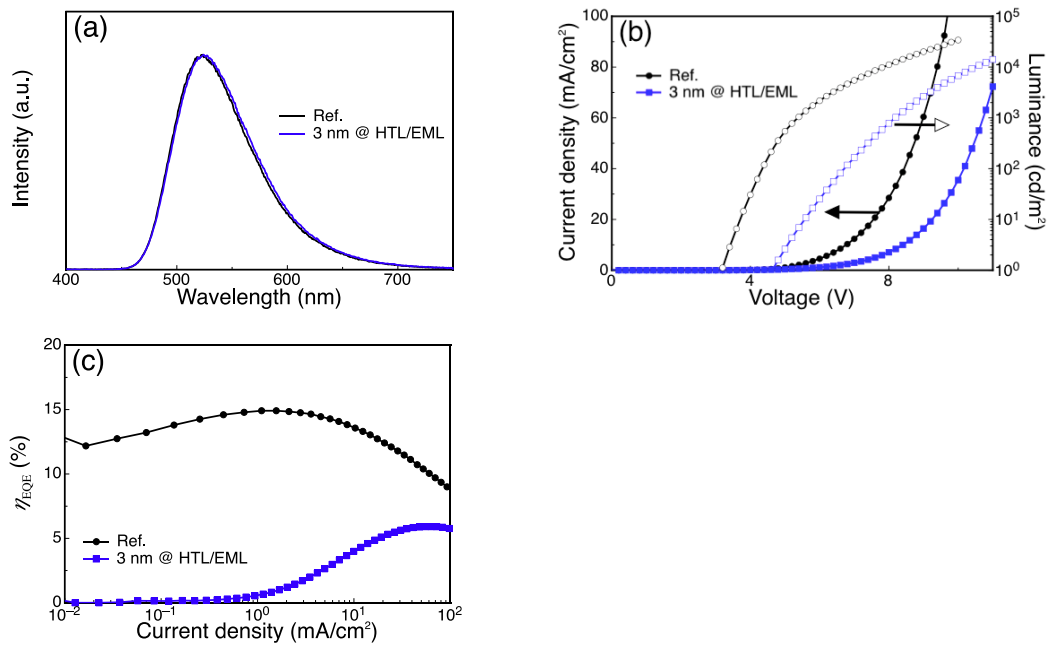
BPy-TP2

Extended Data Figure 1 | Chemical structures of materials in the tested devices.

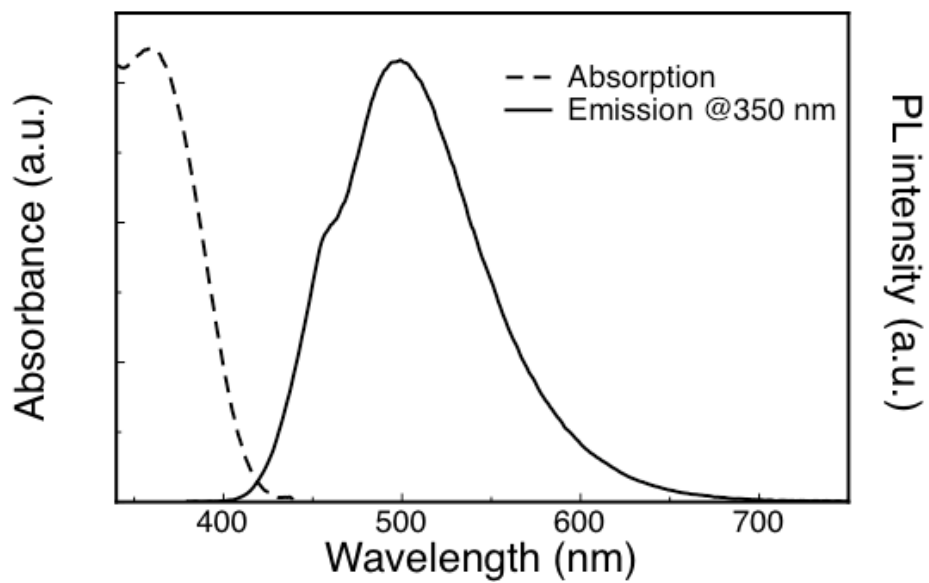




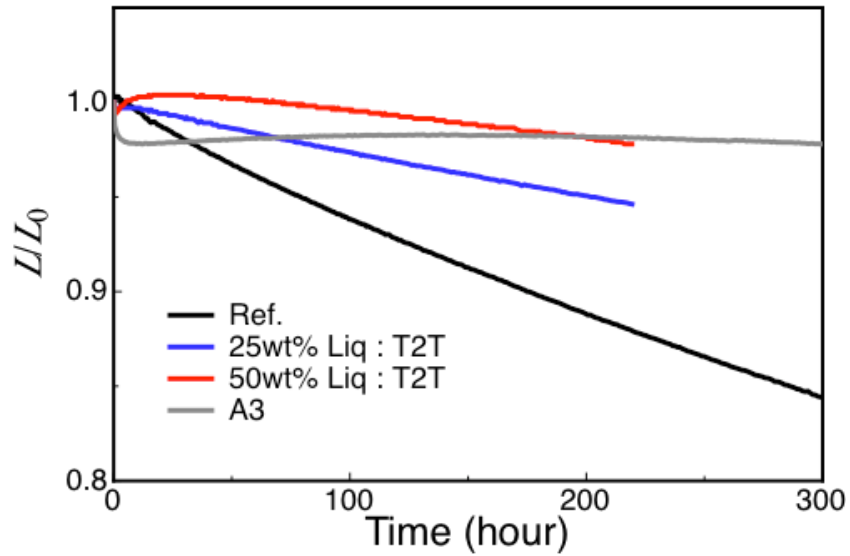
Extended Data Figure 2 | The electroluminescence characteristics of the reference device (Ref.) and a device with a 5-nm-thick Liq interlayer at position A. a, Electroluminescence spectra at 10 mA/cm². **b,** Luminance (empty symbols) and current density (filled symbols) as a function of voltage. **c,** External quantum efficiency vs. current density characteristics.



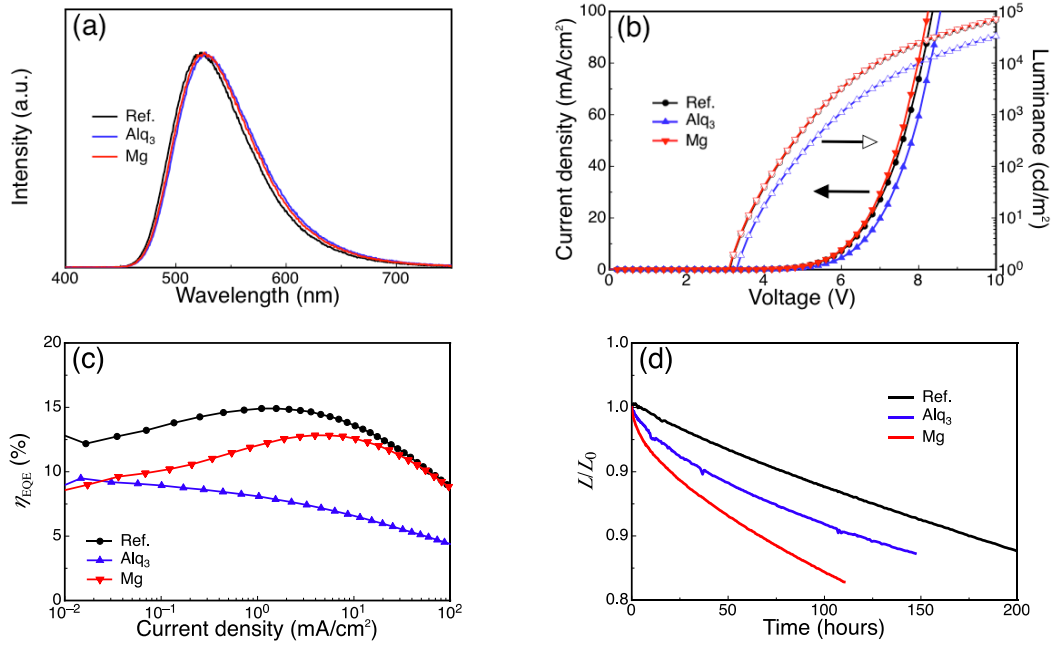
Extended Data Figure 3 | The electroluminescence characteristics of the reference device (Ref.) and a device with a 3-nm-thick Liq interlayer between the HTL and EML. a, Electroluminescence spectra at 10 mA/cm². **b,** Luminance (empty symbols) and current density (filled symbols) as a function of voltage. **c,** External quantum efficiency vs. current density characteristics.



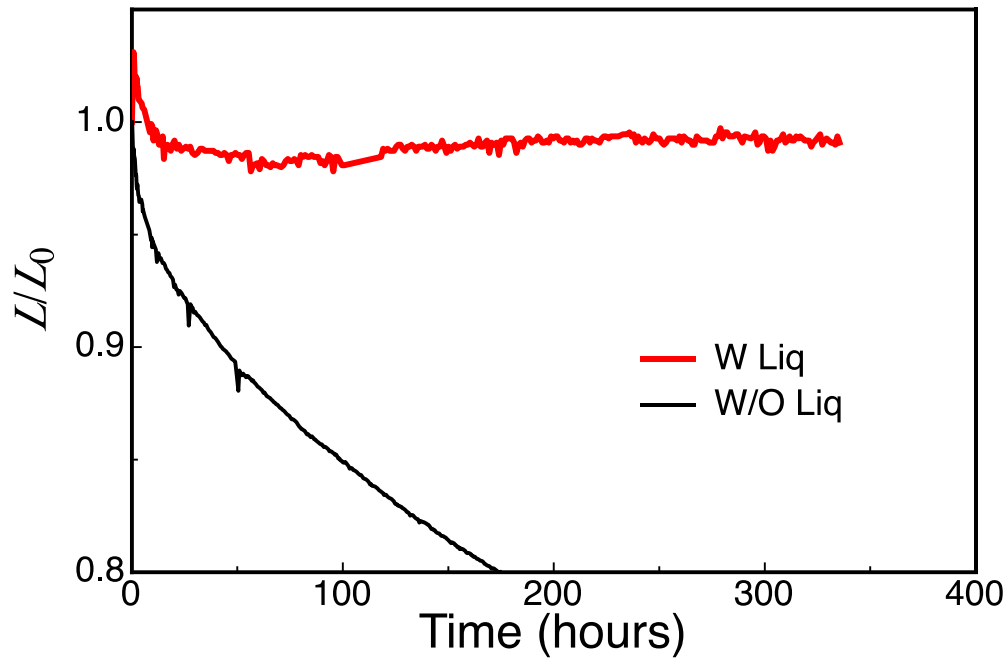
Extended Data Figure 4 | The absorption and photoluminescence spectra of Liq film excited by a 350 nm light source.



Extended Data Figure 5 | Luminance vs. operating time at a fixed current density with an initial luminescence of 1,000 cd/m² for the reference device (Ref.) and devices with an HBL doped with Liq. The structure of the devices with the doped HBML was ITO / HAT-CN (10 nm) / Tris-PCz (30 nm) / 15 wt% 4CzIPN:mCBP (30 nm) / 25wt% Liq:T2T (blue) or 50wt% Liq:HBL (red) / Bpy-TP2 (40 nm) / LiF (0.8 nm) / Al (100 nm).



Extended Data Figure 6 | The electroluminescence characteristics of a reference device (Ref.) and devices with a 3-nm-thick interlayer of either 3 nm Alq₃ or Mg at position A. a, Electroluminescence spectra at 10 mA/cm². **b,** Luminance (empty symbols) and current density (filled symbols) as a function of voltage. **c,** External quantum efficiency vs. current density characteristics. **d,** Luminance vs. operating time at a fixed current density with an initial luminance of 1,000 cd/m².



Extended Data Figure 7 | Luminance vs. operating time at a fixed current density with an initial luminescence of 1,000 cd/m² for phosphorescent OLEDs with and without Liq. The device structure is ITO / HAT-CN (10 nm) / Tris-PCz (30 nm) / 8 wt% Ir(ppy)₃:mCBP (30 nm) / (red curve only) Liq (3 nm) / T2T (10 nm) / Bpy-TP2 (40 nm) / LiF (0.8 nm) / Al (100 nm).