Electronegativity-dependent charge injection into an organic light-emitting diode based on driving voltage region

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We studied charge injection mechanism using organic light-emitting diode which was made difference of thickness of LiF (injection layer), then analyzed various kinds of curves (Luminance-Voltage (L-V), Current density-Voltage (J-V) and Current efficiency-Voltage (CE-V)) splitting thickness of LiF (5Å/10Å/15Å).

In this paper, we divided two voltage regions (Low voltage region (LVR): under 7V), (High voltage region (HVR): over 7V) and probed operational mechanism separately.

Driving voltage in L-V curve (100cd/m^2) is 6.7V(5Å), 6.2V(10Å), 6.1V(15Å) and Current efficiency is more higher 1.15cd/A (at 15Å) than 0.729cd/A(5Å), 0.76cd/A(10Å) (Fig.1(a)). However, Maximum current efficiency (in HVR) is two times higher 2.61cd/A (5Å), 2.95cd/A(10Å) than 1.31cd/A (15Å) (Fig.1(b)).

In 5Å thickness of LiF, relatively amount of fluoride ion is shallowly deposited, it cause reduction of surface dipole and deficient attractive force. In case of 15Å, effect of electronegativity of fluoride ion was superior to that of electric field in LVR, then easily attracted electron into transport layer and got a high luminous efficiency (Fig. 1(c)). But, when more thicker than previous layer, characteristic of insulator is more dominant, then decreased amount of tunneling electron through LiF interlayer in HVR. We confirmed that current efficiency and luminance were decreased, while large current flows.

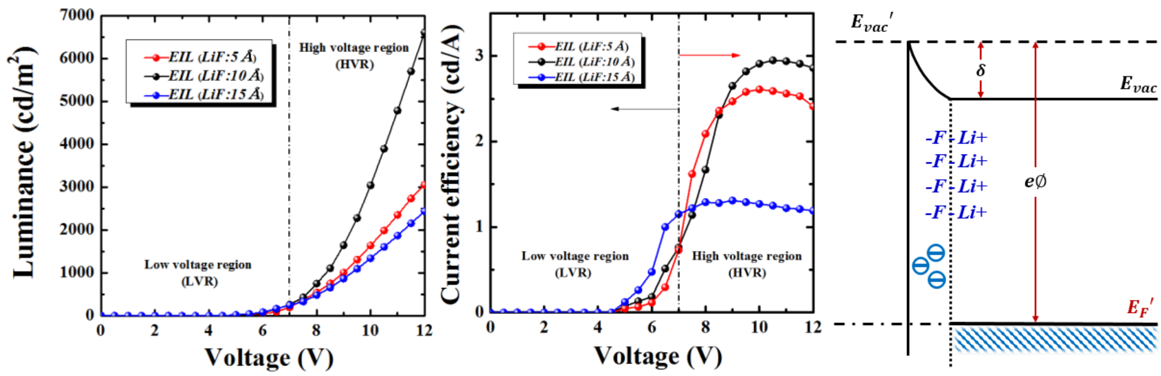

Fig. 1 (a) Luminance – Voltage (L-V) characteristic graph

(b) Current efficiency – Voltage (CE-V) characteristic graph

(c) Lowering electron injection barrier by surface dipole of LiF