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Long-life, Low-cost, Highly Efficient OLED Developed

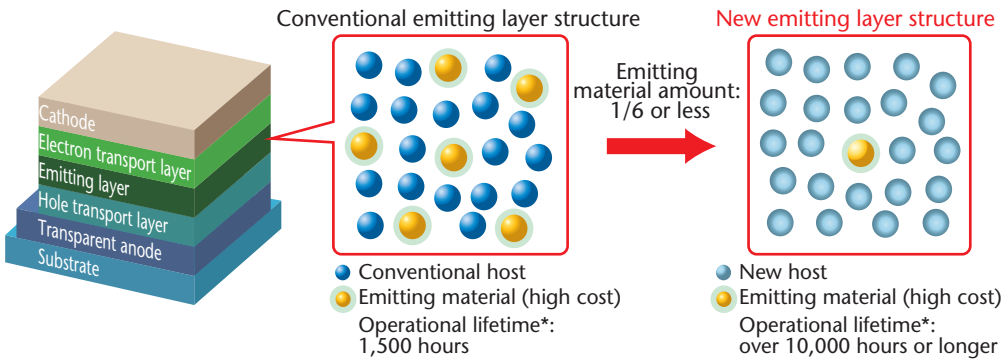
With the aim of making an ultra-thin, lightweight, roll-up, flexible display, NHK has been studying OLEDs* based on phosphorescent materials that have higher emission efficiencies than conventional fluorescent materials. We recently succeeded in extending the lifetime of the device at a lower cost.

The emitting layer of OLED is composed of an emitting material and a host material that transfers electrical energy to the emitting material. While organic metal compounds containing rare metals such as iridium are commonly used for phosphorescent materials, it has been very challenging to reduce the high cost associated with such rare metals.

One way to reduce the cost is to use less of the expensive emitting material. However, so far, the emitting material has had to make up more than 6% of the layer in order to maintain a long operational lifetime. Our recent advance incorporates a new host material with better electrical energy transfer capability that can extend the operational lifetime to seven times that of previous models, even when the emitting material constitutes only 1% of the layer. It is now possible to produce a brightness equivalent to conventional displays by using a much smaller amount of emitting material. This is expected to lead to lower prices (Figure).

Our future work will involve examining red- and blue-emitting phosphorescent organic EL devices with the goal of early implementation of highly efficient, long-life, flexible display devices.

* OLED (organic light-emitting diode): a light-emitting diode in which the emitting layer is a film of organic compound which emits light in response to an electric current. Positive holes and electrons injected into the device recombine within the emitting layer's host material, and an emitting material receives the electric energy needed for light emission.



* Operational lifetime: the estimated time for the initial luminance (1,000 cd/m²) to drop to 50%. Candela (cd) is a basic unit of luminous intensity.

Figure: Structural diagrams of OLED and emitting layers