



## New OLED Cathode Materials with Tailored Low Work Function

Organic light emitting devices (OLEDs), in which the light emitting material is an organic molecule, polymer, metal complex, or a combination of the above, are known to produce intense light emission with relatively little power consumption. OLEDs are composed of three essential elements: the anode, a light emitting layer, and the cathode. The requirements of the cathode and anode limit the types of organic material that can be used for the light emitting layer. It is important to have the work functions of the conductors matched to the appropriate energy levels of the light emitting material. Typically the anode is indium-tin oxide (ITO) and the cathode is a metal such as calcium or magnesium. To increase the stability of the device, these metals are usually alloyed with or covered by silver. The primary barrier to commercialization of these devices is their failure rate, which can often be attributed to degradation of the cathode material and reactions at the cathode-organic layer interface. Recent approaches such as the addition of an insulating layer and separation of the organic material have improved the performance of the interface, but add manufacturing steps.

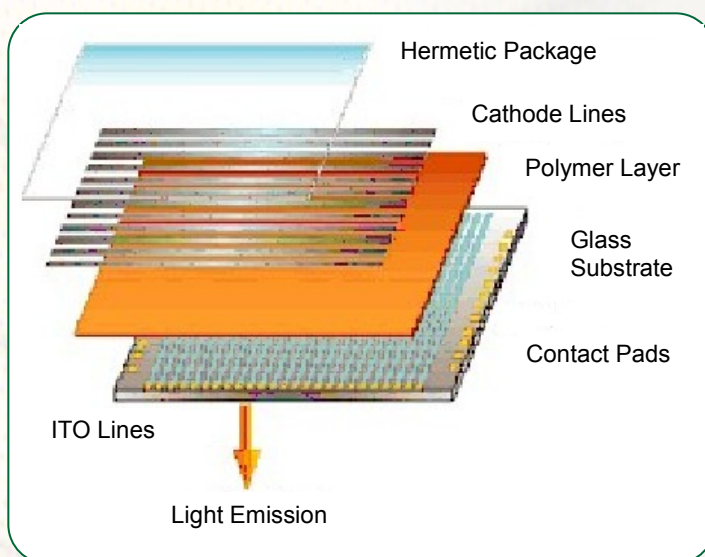
In certain situations the most desirable light emitting material cannot be used due to the above limitations. The novel low work-function metal complexes developed by researchers at Colorado State University offer a viable alternative to the standard cathode technology. These complexes can be electrochemically or chemically reduced at a potential more negative than -0.5 volts vs. the NHE reference electrode to produce a material that is electrochemically conducting in the solid state and can therefore be deposited to form electronically conducting thin films. These reduced materials have a low work function and therefore can function as cathodes for the OLED. They can, in principle, be covered by any conductive material to provide a stable and rugged contact.

The energies, and therefore the work function of the metal complexes, can be controlled by synthetic modification of the starting material, thereby providing a tailor made cathode having the desired work function to match the active organic layer.

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### Features and Benefits

- Low work function of the cathode material results in low operating voltages.
- Work function of the cathode is easily optimized to match the active organic layer.
- Greater flexibility in choice of metal contact material.
- Novel cathode material is easily integrated into current device fabrication processes.

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