



HIGHLIGHTS

General Features

- ❑ The purest alkali metal source to increase electron mobility and lower electron injection power
- ❑ New alkaline-earth metal dispenser model for Top Emission OLED technology
- ❑ Extreme ease-of-operation and control during the evaporation process, from lab testing to pilot and mass production
- ❑ Environment friendliness and safe handling, even in air

Organic Light Emitting Diode (OLED) displays offer the promise of revolutionizing the flat panel display industry. The OLED is emissive, so it needs no backlighting structure, allowing the thinnest possible flat panel configuration.

OLEDs also promise the reality of flexible displays. At present, efforts are under way to make OLEDs more energy efficient than the competing display technologies, mainly through improvements of electron transfer from the cathode.

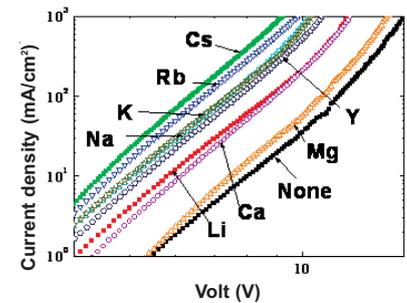
SAES® Getters' AlkaMax® offers the unique opportunity of using a safe and stable source to lower the operating voltage, increase luminosity and improve OLED production yield.

Boosting OLED Performance

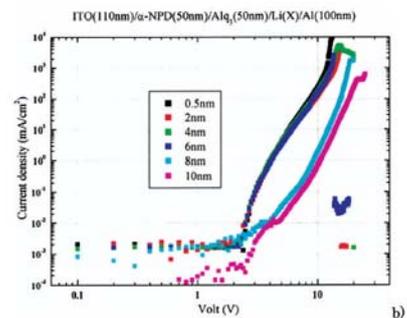
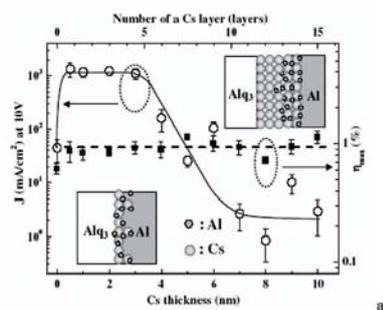
While low work function alkali metals and alkaline earths successfully lower the electron injection barrier and increase electron injection to the organic layer, their implementation as cathode materials is not easy. Control of the composition is difficult and layers such as LiF or Li₂O are insulators, so they must be kept extremely thin.

The use of a pure alkali metal layer (e.g. Li or Cs) can overcome these drawbacks: through AlkaMax, a thin layer of metallic cesium or of another metal can be easily and reliably created, exploiting all the advantages of a low work function metallic layer.

J-V characteristics depending on the work function of cathode. Device with ITO(110 nm)/α-NPD(50 nm)/Alq3(50 nm)/metal(0.5 nm)/Al(100 nm)



Device with ITO(110 nm)/α-NPD(50 nm)/Alq3(50 nm)/metal(X nm)/Al(100 nm). a) Current density (J) at 10V and maximum quantum efficiency (η_{ext}) with Cs. b) Current density-voltage (J-V) characteristics with Li.



With AlkaMax concept it is also possible to realize Alkali Metal Doped Organic Layer (AMDOL) between the cathode and the emission layer to lower the device operating voltage. Cs has been the most effective alkali metal for this layer, as it has the lowest work function among all alkali metals and still retains this superior feature even when co-deposited with the organics.

The AMDOL can be made thick enough to prevent spikes in the ITO anode layer from causing shorts in the device.

Moreover, magnesium or Mg composite cathodes (using the co-deposition of silver for instance) are widely used for many OLED and TOLED device cathode structures.

SAES metal dispensing technology can assure, also in case of magnesium, stable and accurate deposition rates.

AlkaMax: an Advanced Solution for OLED Mass Production

Alkali Metal Dispensers (AMD) have been available from the SAES Getters Group for over 30 years and offer an efficient and safe method of depositing ultrapure alkali metals. AMDs keep the alkali metal pure in the form of a stable salt.

Traditional AMD configurations release a few mg of alkali metal. To meet the specific needs of OLED manufacturers, larger AMD dispensers were necessary: AlkaMax products have been designed purposely to release enough alkali and alkaline earth metals to deal with the demands of OLED mass production.

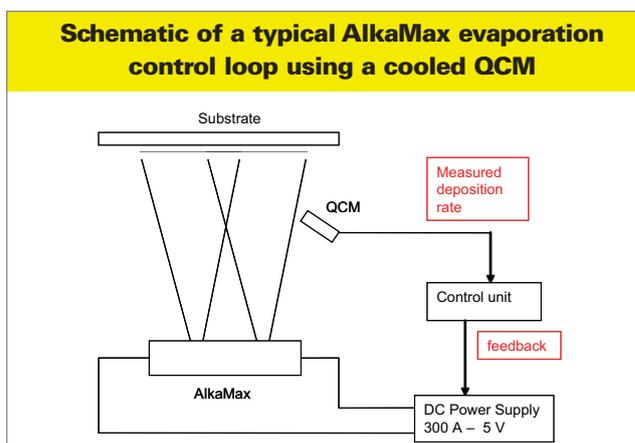
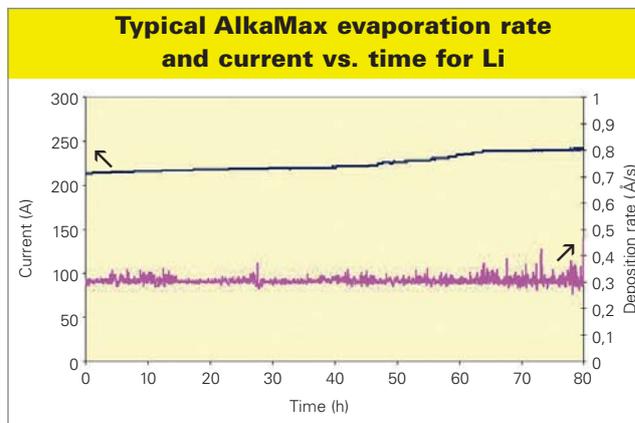
AlkaMax models developed at SAES Getters' Research & Innovation laboratories ensure safe handling in any condition, thanks to the unique nature of the metal precursors. This also ensures that AlkaMax is fully compliant with the environmental regulations.

AlkaMax Characterization and Performance

The special design of AlkaMax can achieve the required alkali metal evaporation rate in a homogeneous, fast and easily controllable way.

A simple feedback control loop can be used to efficiently control the evaporation rate, through a calibrated Quartz Crystal Monitor with forced cooling.

The SAES Getters Group integrates its offer to OLED manufacturers with mathematical modeling, which assures that alkali distribution is fully optimized for ultimate display success.



The SAES Getters Group manufacturing companies are ISO9001 certified, the Asian and Italian companies are also ISO14001 certified. Full information about our certifications for each company of the Group is available on our website at: www.saesgetters.com

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