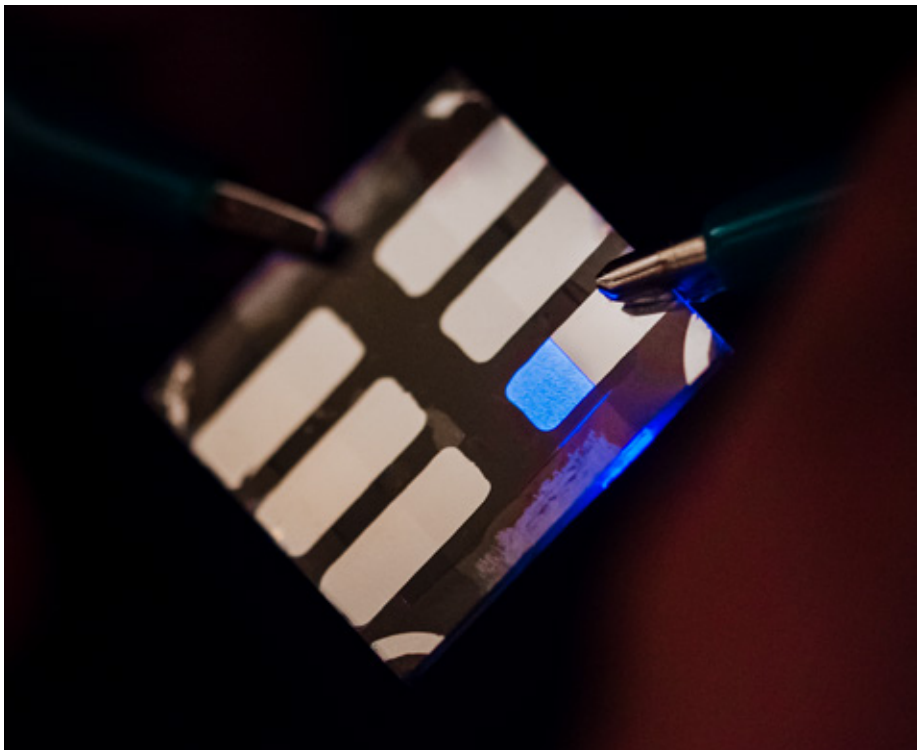
materize

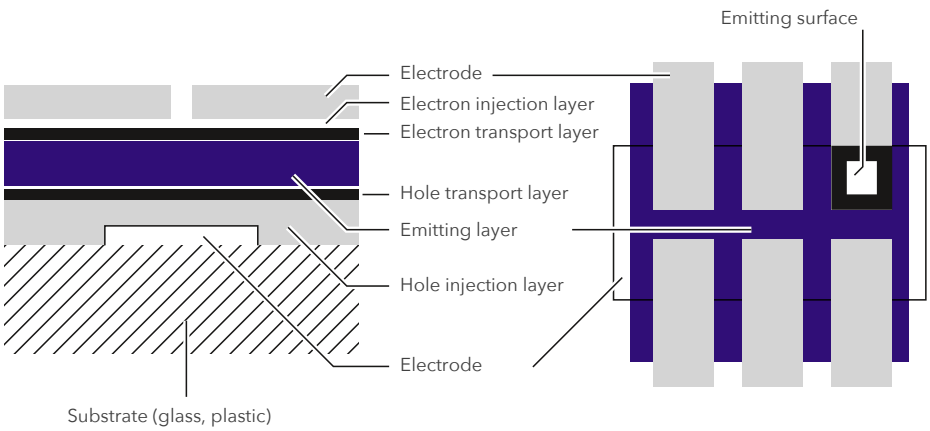
Organic Light Emitting Diode (OLED)

Investigation of organic materials and prototyping of organic light emitting diodes (OLED) for innovative screens and lighting applications



Materize is highly competent in organic materials. This includes both sides: original material research, as well as technical possibilities to fabricate experimental devices for various organic materials' applications. Also, broad options of characterization of materials and devices are available.

Organic materials are used in many innovative applications as organic light emitting diodes (OLED) for screens and lighting devices, transparent and flexible organic photovoltaics (OPV), optical modulators etc. Our modern infrastructure allows working with any application of organic materials.



OLED PROTOTYPING

In our OLED example you will see many of our possibilities.

We will make and characterize an organic light emitting diode after the particular design seen below. The Thickness of each layer varies from 0.5nm to 200nm.

materize

CLEANROOMS

The fabrication of the OLED device takes place in our cleanrooms with an ISO classification of 7-8.

We have the only classified laboratory cleanrooms in Latvia; suitable for the setting up of the material acquisition technologies and research in materials science and nanomaterials.

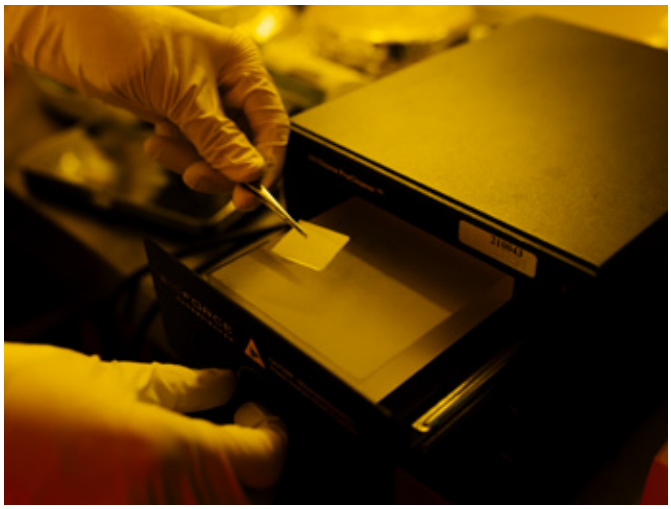
MATERIAL SELECTION

To fabricate your own device, we can offer you commercially available materials to work with, or you are welcome to bring your own materials. We also have a broad collaboration with chemists from many countries, enabling us to develop new original organic materials. In the case pictured here we used original light emitting material for OLED, synthesized by our partners - chemists from Riga Technical University.

SUBSTRATE PREPARATION

The substrates have been cleaned up to standard, including an ultrasonic bath and ozoniser.

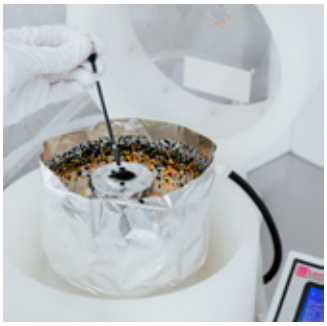
For our OLED we use transparent ITO substrates to form bottom electrode but other different materials can be used and any shape of bottom electrode can be made.



WET CASTING OF MATERIALS

We use several methods to produce all the required layers for our device. One of the methods is wet chemical coating. For materials that can be harmed by oxygen a wet chemical coating can be done in inert atmosphere (Ar), as it was in our OLED case. For that reason we have a spincoater placed in the glowbox and, also, all solutions are prepared in the glowbox.

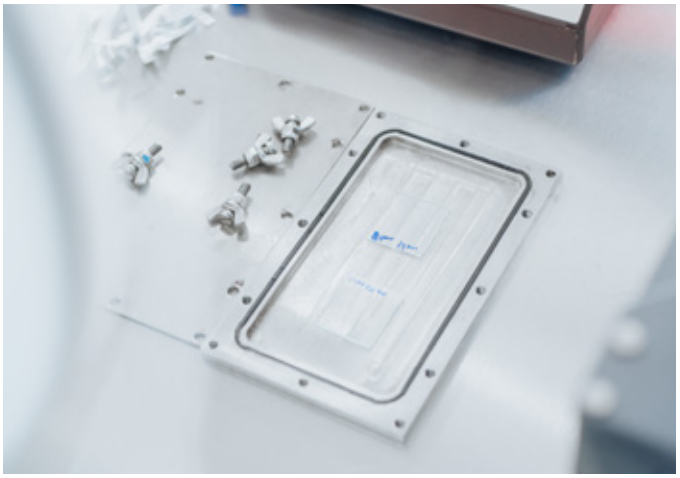
If we need to transport the device to other systems we use a specially designed box, thus we can ensure that devices stay in Ar atmosphere.

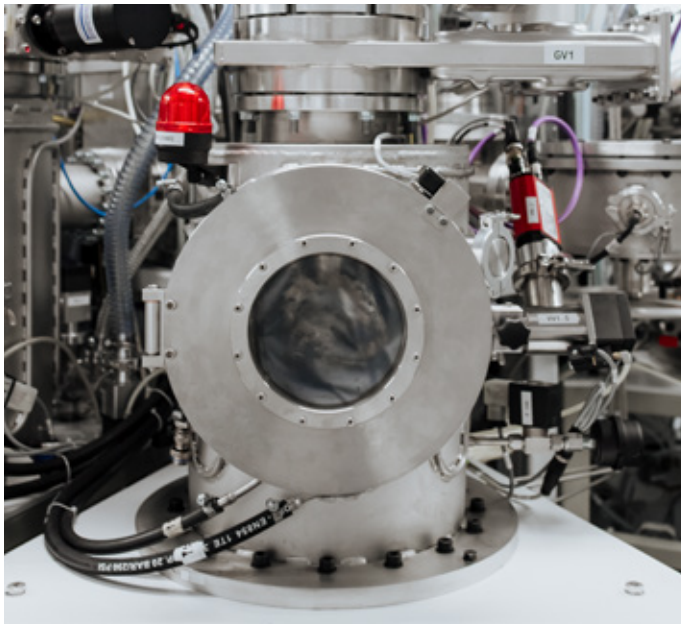


materize

SUBLIMATION OF MATERIALS

Other methods for thin layers fabrication include thermal evaporation in vacuum. We have decades of experience in thin film preparation by material thermal evaporation in vacuum. The thermal evaporation in vacuum of organic and metallic materials can be combined with magnetron sputtering and plasma cleaning methods in SAF 25/50 vacuum coating cluster system located in the clean-room facilities where devices are easily transported in-between various process chambers by automatic manipulator. All processes are managed through control software.





To fabricate an organic layer and upper electrode for our OLED in this case we use the SAF 25/50 vacuum coating cluster. We put the device in the system through glowbox to ensure an inert atmosphere.

First we add a sublime organic layer, then the upper metallic electrode. In our case it is aluminium, but we can make thin films of many metals. During the sublimation process we can control thickness, sublimation rate and substrate temperature. In our cluster system, we can reach a vacuum of 1x10-6mbar.

ENCAPSULATION

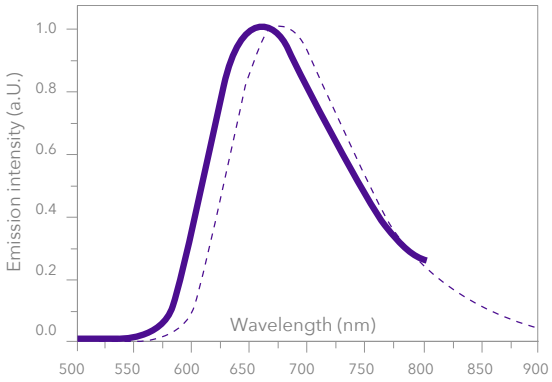
Our OLED device is ready after encapsulating in protective layer done in glowbox with inert Ar atmosphere.

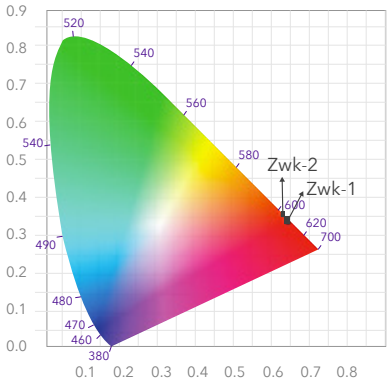
materize

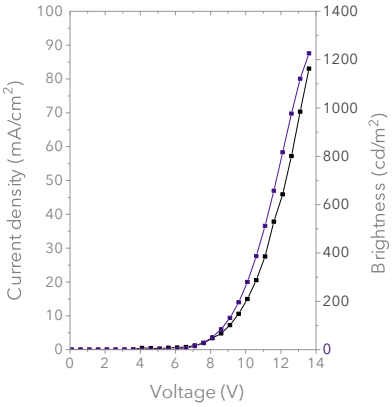
CHARACTERIZATION

For OLED devices we can measure electroluminescence and photoluminescence, we can also determine the colour of electroluminescence in CIE coordinates.

We also determine current-voltage-brightness characteristics which gives us information about the efficiency of our device (current and power efficiency). Knowing all characteristics, we can tell whether the OLED we have made is better than those in the market.







MATERIAL RESEARCH

Prior to our OLED fabrication we make: Ionization energy measurements (photoelectron spectroscopy method, determination of the energy structure of materials forming OLED), Electron affinity energy determination (Spectral dependence of intrinsic photoconductivity, determination of the energy structure of materials forming OLED), Luminescence spectra measurements (determination of emission spectra of compound), Photoluminescence quantum yield determination (determination of the highest possible efficiency of OLED), Charge carrier mobility determination (Time of Flight technique).

MORPHOLOGY

We also do analysis of morphology of all deposited layers using a high resolution optical microscope (Fig A) and scanning electron microscope (Fig B).

Fig A

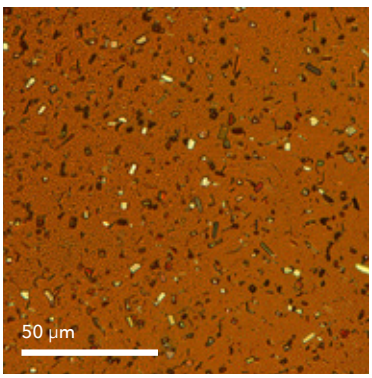


Fig B