ynvisible

INK KIT Introduction

The electrochromic (EC) Ink Kit is intended for industrial and academic R&D groups, as well as professional designers, who are interested in learning about electrochromics and its potential applications.

Successful use of the kit assumes basic knowledge in printing and electronics, and access to screen printing capabilities, heat and UV curing equipment.

What you need to get started

- Sharp Knife
- Multimeter
- Screen Printer
- Knife Coater (manual coating with spatulas/blades is also possible)
- Laminator (manual lamination is also possible)
- Oven (for heat curing)
- UV Lamp (for UV curing)
- Power source to activate the displays (e.g. 1.5V and/or 3V coin cell batteries)

Electrochromic (EC) Displays

What's inside

Inks
Silver ink, 150g
Electrochromic ink, 200g
Ynvisible Electrolyte, 200g

Substrates
PET, 125µm, **40** A4 sheets
PET-ITO, 125µm, **40** A4 sheets
Bi-adhesive spacer, 220µm, **40** A4 sheets

For safety reasons, a properly ventilated space is necessary for the production of EC displays using ynvisible's Ink Kit. We recommend that all production steps are conducted in a fume hood. If a fume hood is not available, a simple air/fume extraction system (such as the ones used for soldering) should be used.

Please wear protective gloves/protective clothing/eye protection/face protection.

Ink	Safety	Deposition	Recommended Curing Conditions	Recommended Cleaning Agent	Recommended Screen Mesh
Silver		Screen Printing	Heat (130°C, 5min)	Methyethyl Ketone	Polyester 68-110 wires/cm Stainless steel 90-150 wires/cm
Electrochromic		Screen Printing	Heat (130°C, 1,5min)	Water	Polyester 77-140 wires/cm
Electrolyte		Coating	UV Wavelengths up to 420 nm*		-

**e.g. Using a UV lamp with 250mW/cm² and a distance between the display and the UV lamp of 5cm, the exposure time should be around 1 minute.*

The Ink Kit can be used to produce reversible EC displays with 2 different display architectures: co-planar and vertical displays. The main difference between these two architectures is that on vertical displays the functional materials are deposited on two different substrates/planes, while in the co-planar architecture all the materials are laid down on the same substrate/plane. More information on how to produce co-planar and vertical devices can be found in the next sections of this document.

Co-Planar Displays

Co-planar displays have 2 electrodes printed side by side (see main electrode 2a and counter-electrode 2b in Figure 1). In order to activate the main electrode on a co-planar display, a voltage level of 3V must be applied to the counter-electrode, while keeping the contact on the main electrode connected to ground. The main steps in assembling a co-planar display are depicted below (Figure 2). Using PET film, start by screen printing and heat curing silver ink to create the conductive tracks and interconnection pads for the display (1). Repeat the same for the EC ink on the same PET substrate (2). Pre-cut the spacer material in the shape of a frame that will fit the edges of the display. Remove one liner from the spacer and laminate the spacer frame on top of the bottom PET substrate, applying pressure to improve adhesion (3). DO NOT REMOVE the top liner of the spacer yet. Apply an adequate volume of electrolyte inside the spacer frame and coat the electrolyte layer using a knife coater or a spatula (manual coating) (4). Remove the top liner of the spacer frame and cure the electrolyte with a UV lamp (5). Finally, laminate the top protective PET film (6). Optionally, you may use an extra curing step using the UV lamp again, to make sure the electrolyte is fully cured.

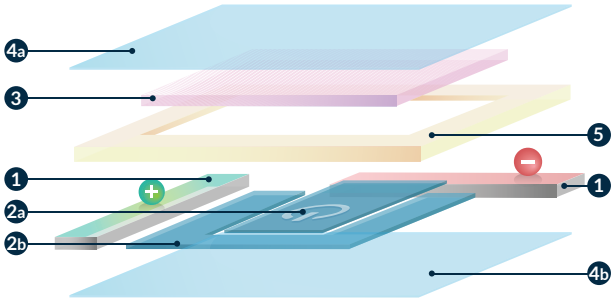


Figure 1

What you need to produce co-planar displays

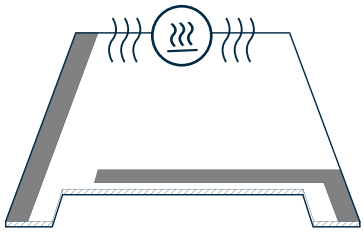
Inks

1. Silver ink
2. Electrochromic ink
   a) Main electrode b) Counter electrode
3. Ynvisible Electrolyte

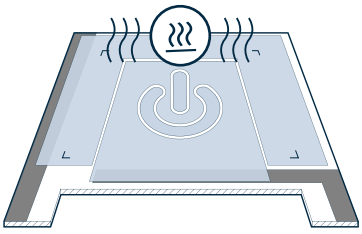
Substrates

4. PET, 125µm
   a) Top PET substrate b) Bottom PET substrate
5. Bi-adhesive spacer, 220µm

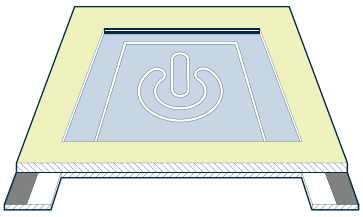
Step by step production of co-planar displays



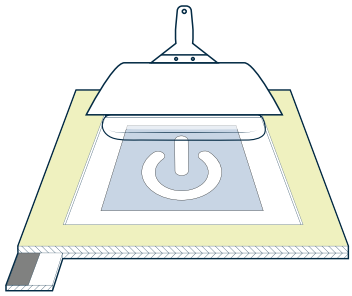
① Screen printing of silver tracks onto bottom PET substrate followed by heat curing of silver ink at 130ºC.



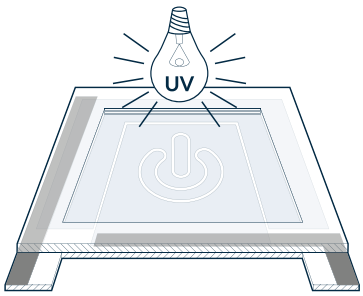
② Screen printing of EC ink onto bottom PET substrate followed by heat curing at 130ºC.



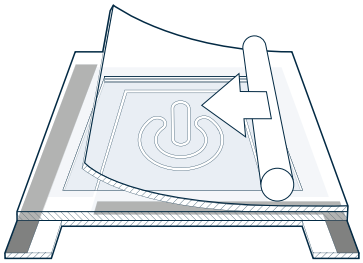
③ Lamination of pre-cut bi-adhesive spacer on the bottom PET substrate.



④ Coating of electrolyte inside the spacer frame.



⑤ UV curing of electrolyte using a UV lamp (the top liner of the spacer needs to be previously removed).



⑥ Lamination of top PET substrate (avoid trapping air bubbles). Final UV curing step optional.

Figure 2

For more information go to:
www.ynvisible.com/ink-kit-description

Vertical Displays

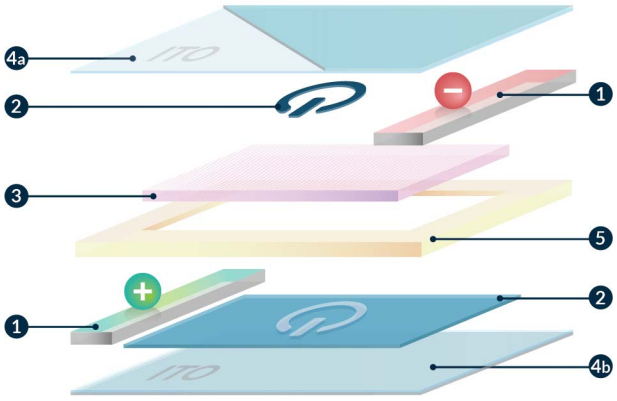


Figure 3

What you need to produce co-planar displays:

Inks

1. Silver ink
2. Electrochromic ink
3. Ynvisible Electrolyte

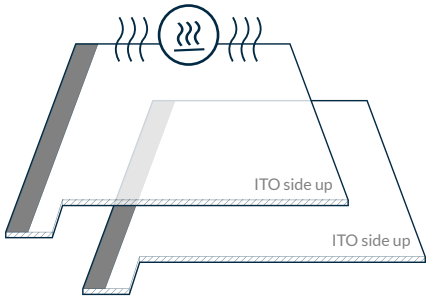
Substrates

4. PET-ITO, 125µm
   a) Top PET-ITO electrode b) Bottom PET-ITO electrode
5. Bi-adhesive spacer, 220µm

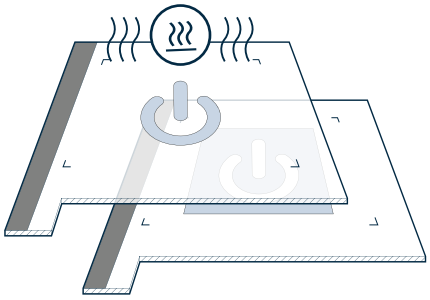
Vertical displays have a sandwich-like structure, in which one electrode is on the bottom substrate and the second electrode is on the top substrate (see top electrode 4a and bottom electrode 4b in Figure 3). PET-ITO film is used as the electrodes in vertical EC displays, since ITO is a transparent conductive oxide. A vertical display can be activated by applying a voltage level of 1.5V to one of the electrodes, while keeping the other electrode connected to ground.

The main steps in assembling a vertical display are depicted below (Figure 4). Make sure to print the silver and electrochromic inks on the ITO side of the PET-ITO film. You may use a multimeter to check for the conductive side of the substrate. Screen print and heat cure silver ink to create the conductive tracks and interconnection pads on both electrodes (1). Repeat the same for the EC ink on both electrodes (2). Pre-cut the spacer material in the shape of a frame that will fit the edges of the display. Remove one liner from the spacer and laminate the spacer frame on top of the bottom electrode, applying pressure to improve adhesion (3). DO NOT REMOVE the top liner of the spacer yet. Apply an adequate volume of electrolyte inside the spacer frame and coat the electrolyte layer using a knife coater or a spatula (manual coating) (4). Remove the top liner of the spacer frame and cure the electrolyte with a UV lamp (5). Finally, laminate the top electrode, making sure that the printed patterns on the top electrode are correctly aligned with the images on the bottom electrode (6). Optionally, you may use an extra curing step using the UV lamp again, to make sure the electrolyte is fully cured.

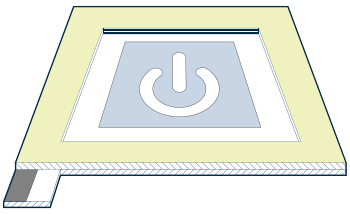
Vertical Display



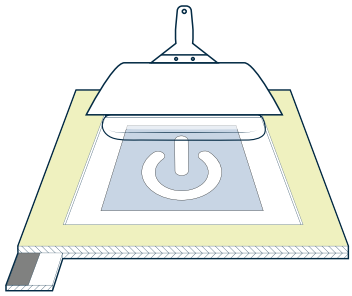
① Screen printing of silver tracks onto PET-ITO (bottom and top electrodes) followed by heat curing of silver ink at 130°C.



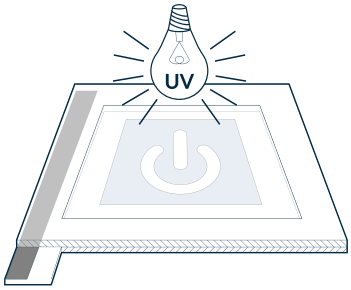
② Screen printing of EC ink onto PET-ITO (bottom and top electrodes) followed by heat curing at 130°C.



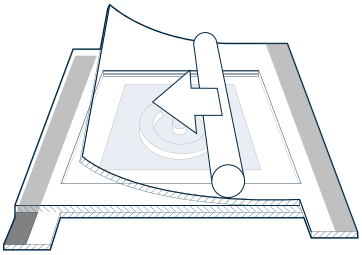
③ Lamination of pre-cut bi-adhesive spacer on the bottom PET-ITO substrate.



④ Coating of electrolyte inside the spacer frame.



⑤ UV curing of electrolyte using a UV lamp (the top liner of the spacer needs to be previously removed).



⑥ Lamination of top PET-ITO substrate, ITO facing down (avoid trapping air bubbles). Final UV curing step optional.

Figure 4

For more information go to:
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