



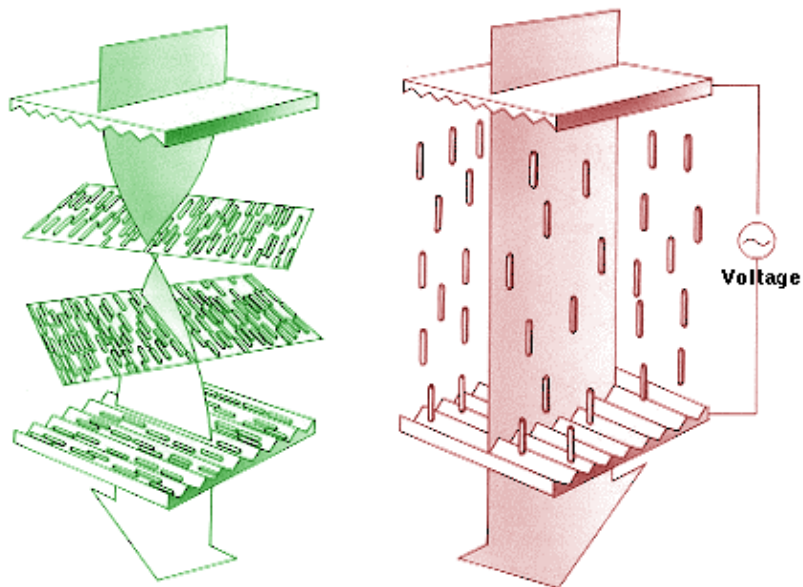


Rubbing machines from Joyo Engineering for LCD manufacturing.		
	<p><b>Joyo Engineering is represented in Europe by</b>  <b>Crystec Technology Trading GmbH</b></p>	
 <p><b>Content</b></p>  <p><b>Contact</b></p>	<p><a href="#">English</a> <a href="#">deutsch</a> <a href="#">francais</a>  <a href="#">Joyo Japan</a> <a href="#">Company</a> <a href="#">LCD</a> <a href="#">Printing</a> <a href="#">Rubbing</a>  <a href="#">Assembly/Hot Press</a> <a href="#">Scribe/Break</a></p>	<input type="text"/> ?

## Joyo Engineering : Rubbing Technology for LCD Manufacturing.

Liquid crystals act like shutters in display screens. When a LCD pixel is 'open', light can pass the display; when it is 'closed', the pixel turns dark. This switching is induced by an electric field. A typical LCD cell consists of a liquid crystal, sandwiched between two perpendicular polarizing filters. Light enters through the first filter, is twisted by the liquid crystal according to the orientation of the molecules, and exits through the second polarizer. If an electric field changes the liquid crystal molecule orientation, the light, being no longer twisted in the right way, cannot pass the second filters any more: The pixel goes dark.



This assembly requires that the liquid-crystal molecules at the two glass surfaces of the cell can be arranged in parallel to the two polarizer foils. This is achieved by coating the surfaces of the cell with a thin, transparent film of polyimide, comprising long chain-like molecules. When this film is rubbed by a velvet cloth, microscopic grooves are generated in the polyimide layer and the molecule chains line up in the rubbing direction. This guides the liquid crystals at the surface into the same orientation. The result is a twisted or helical structure of the liquid crystal molecules which try to align parallel to each other. The tilt of the molecules is larger in the mid layer of the display due to the restoring forces of the molecules anchored on top of the orientation layer. A proper orientation of the liquid crystal molecules versus the orientation layer results in low addressing voltage of the pixels in the display, while misorientation of single crystals molecules requires an increased electrical field.

Therefore, rubbing is an important process step in LCD manufacturing. The proper anchoring of the liquid crystals in the orientation layer depends of:

- Printing technology of the polyimide layer. Normally [flexo printing technology](#) is used. Printing direction, antiparallel to the rubbing direction increases the orientation effect of the liquid crystals.
- Well defined and homogeneous rubbing of the layer by a velvet rubbing cloth.

Joyo rubbing machines use automatic or manual loading and unloading of the glass plates. The glass is held by vacuum on the chuck. A large, gantry aluminium rubbing roller, strung by a special velvet rubbing cloth is guided vibration less and in diagonal direction over the orientation layer by well defined speed and angle, precisely adjusted pressure and adapted rotation. Flatness of the rubbing table, consisting of fine alumina ceramic is very important. The rubbing process can generate particles. Therefore a proper air flow management, using HEPA filters is required. Glass plates are cleaned ultrasonic. Electrical charging of the glass plates is measured and discharging done by an ionizer. A special mechanism eases the dismantling and the installation of the rubbing rollers and the covering with the rubbing cloth.



Rubbing machine in action



Unloading of the glass plate,  
rubbing wheel without cloth

The following steps are performed on the machine:

- Transport from the former process to the rubbing machine.
- Standby position of the glass plate.
- Loading of the glass plate: Air cylinder pins are lifted. Glass is transported to the chuck. Pins are lowered and vacuum fixes the glass plate.
- Ultrasonic air cleaning of the glass plate.
- Measurement of substrate thickness and adjustment of the roller height.
- Rotation of the glass plate and rubbing.
- Rotation of the glass plate, unloading and transport to the following process.

Crystec Technology Trading GmbH will be pleased to further discuss details with you.



Content  
Page



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Top of  
Page