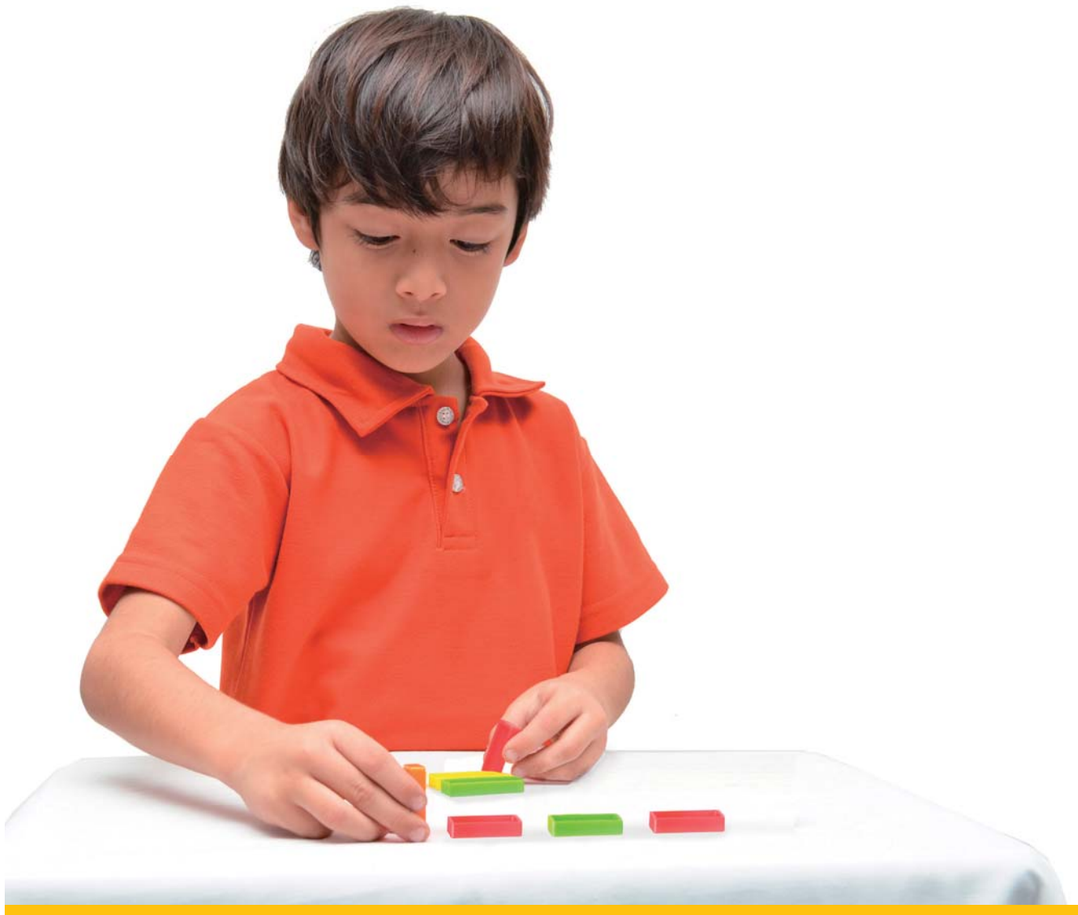
Aligning

Slim, beautiful and ecologically-friendly.
The proliferation of mobile terminals such as Smartphones has been accompanied by increasing evolution of liquid crystal displays.
The increased performance of such displays is backed up by Ushio's photo-alignment technology for uniformly arranging liquid crystal molecules.



It is the uniformity with which liquid crystal molecules are arranged that determines the quality of images

External appearance of photo-alignment system and the lamps used for photo-alignment

Liquid crystal displays express image movement, colors and shades by applying voltage to liquid crystal molecules to move them in a shutter-like manner, controlling the amount of light that passes through from the display's backlight. Accordingly, improvement in the quality and speed of images depends on the freedom with which liquid crystal molecules can be moved, which is what makes it so important that the molecules be regularly aligned.

However, in practice this is not so easy to achieve. As with crystals, liquid crystal molecules have a tendency to clump together, so they fall into disarray if left to themselves. The important process of arranging liquid crystal molecules so that they are correctly positioned into the proper orientation is achieved through photo-alignment.

Various types of alignment

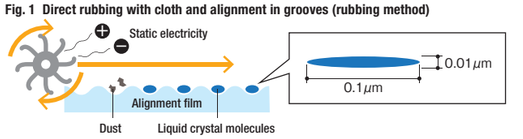
Conventionally, liquid crystal molecules are aligned by rubbing them with cloth to orient them within grooves as shown in Figure 1. However, this method is not only problematic from an ecological and economic perspective, but in terms of other problems such as darker images and reduced contrast.

These problems are all solved by Ushio's optical alignment technology. Exploiting their tendency to change arrangement under the influence of an electromagnetic field, Ushio has succeeded in arranging liquid crystal molecules by irradiation with special light, a method that does not rely on direct rubbing or use of alignment structures. This non-contact method of alignment not only increases production yield by reducing dust and static electricity, but also reduces cost by eliminating the need for alignment structures. Furthermore, it improves contrast and allows greatly reduced power consumption by improving backlight transmissivity (Figure 3).

The display of that Smartphone you are using may have been produced using Ushio's photoalignment technology.

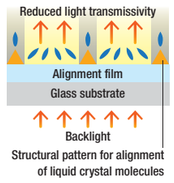
"Aligning with light" The Mechanism

Fig. 1 Direct rubbing with cloth and alignment in grooves (rubbing method)



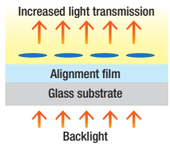
Yield suffers due to fine dust (particles) and generation of static electricity. The special cloth used for rubbing is not only expensive, but must be frequently replaced, increasing production cost and lead time.

Fig. 2 Liquid crystal molecules are aligned with a structural pattern



Structural pattern used for liquid crystal alignment impedes light transmission, making images darker and reducing image quality. Increasing the brightness requires a larger backlight, which increases display size. This method also leaves irregularities in liquid crystal ordering and angle, reducing response speed.

Fig. 3 Ushio's optical alignment technology



Liquid crystal molecules regularly aligned in one direction without structural patterns by means of irradiation with special light. Improved light transmission reduces power requirements and achieves greater alignment regularity for improved contrast.