

Scientists unlock the mystery of the mechanics of liquid crystal alignment

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The alignment of liquid crystals in devices such as lap-top computers and palm pilots makes the displays on these devices readable. For more than 30 years, scientists have worked to understand the exact mechanism responsible for liquid crystal alignment, to no avail – until now. A group of researchers at Kent State University, headed by Dr. Satyendra Kumar, professor of physics, have finally uncovered the mechanisms of liquid crystal alignment.

The results of a Kent State study of a variety of glass substrates of the type used in liquid crystal displays (LCDs) revealed for the first time the way liquid crystals align. All substrates used in LCDs have anisotropic surface roughness. Such a surface is smooth along the grooves but rough in the perpendicular direction.

When liquid crystal molecules in LCDs find themselves near such a surface, they orient parallel to the "smooth" direction. This is true of all surfaces, irrespective of the nature of the surface and the treatment method used to prepare it.

In order to make LCDs work, companies have aligned liquid crystal molecules with the optic axis in liquid crystal displays. The most common method used requires glass plates coated with a polymer that are mechanically "rubbed" with a linen cloth. The surface becomes smooth along the rubbing direction and the LCD's optic axis aligns along the rubbing direction.

Several methods other than rubbing also have been developed, including UV treatment and plasma exposure. The results show that even when the surface is untouched but exposed to polarized UV, it develops a structure that is anisotropic and rough.

Source: Kent State University

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