

LCD as a molecular magnifying glass

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Dutch researcher Johan Hoogboom has developed a technique for making [LCDs](#) (liquid crystal displays) without the need for cleanrooms. This technique is simpler and cheaper than current methods and is based entirely upon the self-ordering of molecules on a surface. Furthermore, the chemist has shown that these LCDs can be used to make DNA visible to the naked eye.

Hoogboom constructed a surface that can align liquid-crystal molecules. For this he designed and produced an aromatic chemical compound. When this was applied to the surface used for the manufacture of LCDs, the molecules automatically organised themselves into a regular pattern. These surfaces could then align liquid crystals, which is a requirement for the construction of LCDs.

Furthermore, the researcher used these surfaces to produce a new generation of biosensors. Hoogboom demonstrated that the aligned liquid crystals could be used to make the effect of an enzyme or the presence of certain types of DNA visible, without the need for extra equipment. This opens up the way for a new generation of biosensors, which can analyse materials on the spot.

An LCD consists of two polarisation filters, placed at 90 degrees to each other. The liquid crystals are oriented parallel to the direction of their respective polariser, which causes them to adopt a helical shape inside the display. Light that passes through one filter, travels through the helix, changes its direction of polarisation by 90 degrees and can then leave through the second filter on the other side. If a voltage is placed across

the display, the helical shape is lost. Light that enters on one side, then no longer changes in polarisation direction and can no longer pass through the second filter, making it appear dark.

To make an LCD, it must be possible to align the liquid crystals in a single direction, so that they are positioned parallel to the direction of both polarisation filters. The present production technique is based on a principle that has already been known for 100 years. In this technique, the aligning surfaces are made in a cleanroom by rubbing a velvet cloth in the right direction over thin polymer layers. Due to the increasing demand for larger and better displays, this method is reaching its technical limits. Further-more, the method is extremely labour intensive and highly sensitive for environmental factors, such as dust.

Johan Hoogboom has received a Talent grant from NWO with which he will take up a post-doc position at MIT in Cambridge (US) in January 2005.

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Source: STW

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