Analytical Instrumentation, Methods & Materials

Low-Power Liquid Crystal Switching Mechanism

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WARF: P02034US

Inventors: Nicholas Abbott, Yan-Yeung Luk

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a device and mechanism for switching the orientation of liquid crystals in displays operating at low potentials.

Overview

Liquid crystal displays (LCDs) are found in a wide range of consumer products, including laptop computers, digital clocks, microwave ovens and CD players. But LCDs are currently unsuitable for certain low-power, portable applications, such as electronic paper and electronic labels, because the mechanisms for switching the orientation of liquid crystals tend to require relatively high amounts of power.

The Invention

A team of UW-Madison chemical engineers has now created a device and mechanism for switching the orientation of liquid crystals in displays operating at low potentials, e.g., less than 200 mV. The device is an electro-optical cell consisting of a liquid crystal layer doped with a salt, which is sandwiched between a counter electrode and a working electrode supported by a substrate. The researchers demonstrated the switching mechanism by building a device that contained a working electrode made of self-assembled monolayers of alkanethiols supported by a gold surface. These monolayers present ferrocene groups at the surface, which can be reversibly oxidized to ferrocenium. As the ferrocene groups are chemically or electrochemically oxidized to ferrocenium, an electrical double layer forms at the surface of the working electrode. The electrical field localized within the double layer then changes the orientation of the liquid crystals sitting on top.

Applications

- Allows the use of LCDs in low-power, portable devices such as electronic paper, electronic ink and electronic labels
- Provides more flexibility in the placement of working and counter electrodes than in current devices, enabling simplified device architectures

Key Benefits

- Reduces the electrical potential needed to switch the orientation of liquid crystals to less than 200 mV
- Redox-active groups are easily patterned on surfaces, making it possible to generate patterned orientations of liquid crystals without the need to pattern an electric field.

Publications

- Luk Y.Y. and Abbott N.L. 2003. Surface-Driven Switching of Liquid Crystals Using Redox-Active Groups on Electrodes. Science 301, 623-626.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Sensors

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854