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Cholesteric liquid crystal phase modulator

Fast LCoS solutions

Researchers in the Department of Engineering have developed a new type of high speed phase modulator based on Liquid Crystal on Silicon (LCoS) technology. This is expected to enable faster optical switches for telecoms applications, higher quality holographic displays and enhanced live cell microscopy. The team is now keen to collaborate with suitable partners for development of the technology.

Key Benefits:

- Very fast, with around 40 µs switching time
- 256 greyscale and very good switching depth
- Low voltage means a small physical size and potentially more applications
- Easy to manufacture using standard foundry techniques
- Polymer free, no grating structure
- Works with off the shelf liquid crystal, and may be optimised using a proprietary liquid crystal mixture

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What problem does this solve?

Ideally, phase modulators would have both very fast response times and a good greyscale range. However, in practice, nematic LCoS phase modulators have good grey scale but sub-optimal response times, whereas ferroelectric LCoS phase modulators have exceptional response times but only two levels of greyscale (as shown in Figure 1). Our technology uses a novel processing method to dramatically improve the response time of a nematic LCoS to 40 µs, while maintaining the other advantages of a nematic LCoS, such as the good greyscale range and wide temperature operating range.

Applications

Nematic LCoS phase modulators are used in liquid crystal displays and telecoms applications. The improved response time could allow for the development of new phase modulators for high-speed internet.

Additionally, the improved response time could allow for their use in live cell microscopy. To date, using phase modulators in live cell microscopy has not been possible due to the relatively slow response time, and a full grey scale range is required to carry out detailed imaging. The combination of improved response time and full grey scale could allow for previously unfeasible applications in live cell microscopy.

Next steps

This technology is protected by a GB priority patent application. We are now looking for partners to help us develop the technology for use in display and telecoms applications. Please contact us to explore this opportunity further.

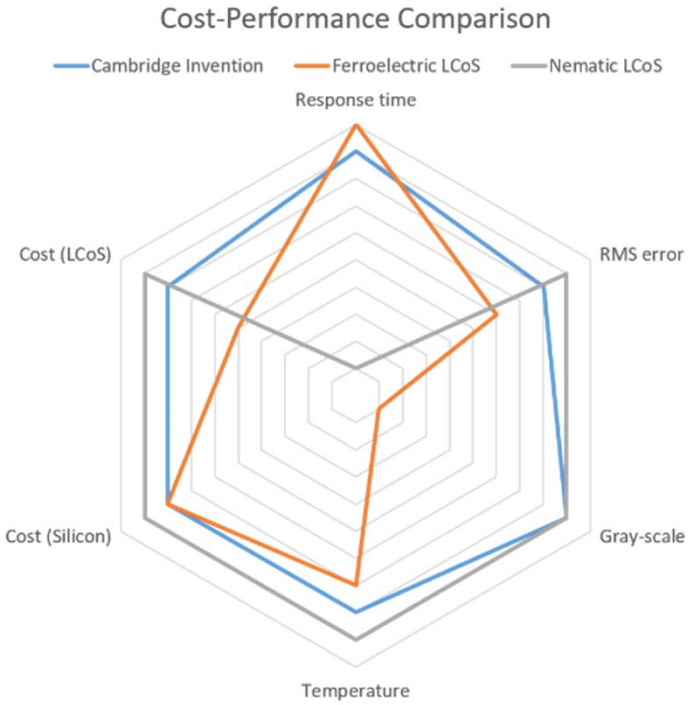

Figure 1: A cost-performance analysis comparing our technology, a typical ferrorelectric LCoS and a nematic LCoS device. The comparison is on response time, cost, grey-scale, RMS error and temperature range.

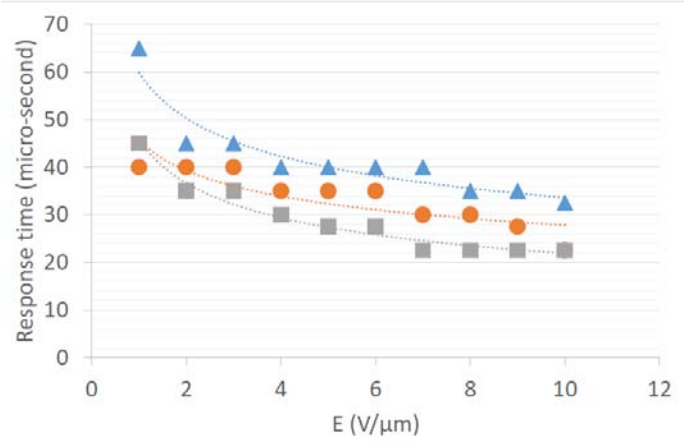

Figure 2: Plot of response time as a function of electric field at different temperatures - 22ºC (Triangle), 30ºC (Circle) and 40ºC (Square).