

Final Report Summary

Optical Feedback for an OLED Display



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Organic light emitting diode (OLED) technology is set to revolutionise the world of electronic information displays. It is the likely successor to LCD and plasma. The polymer variant (P-OLED) in particular offers great promise for low-cost manufacturing. At the same time personal display systems such as video glasses based on microdisplays may well revolutionise the way we access and utilise tv and video. P-OLED microdisplays arguably offer the most promise for future personal display systems.

Like all new technologies, OLEDs have had some teething troubles. For example, like all emissive display technologies, and indeed the backlights of modulating display technologies, OLED displays age with use and gradually become dimmer. A further cause for concern is that pixels within the display age according to how much they are used so that, under certain extreme use conditions, differential pixel ageing can become apparent in the form of a faint retained or ghost image. Today, OLED performance is acceptable for many applications. Improvements in technology - materials, device stack and manufacturing methods - contribute to improvements in display lifetime and image retention. It is also possible to define improved active matrix architectures that assist. These improvements are intended to continue to broaden the market acceptability of the technology.

This project has focussed on one particular approach to the design of the active matrix architecture - namely in-pixel optical-feedback - that is intended to significantly decrease the rate of dimming and significantly delay the occurrence of perceptible image retention. This is a radical approach that carries associated risks. The way in which optical feedback works is as follows - any reduction in the efficiency of the pixel that results in reduced output light amplitude is detected and a compensation signal is generated that increases the ON time so that the (integrated) amount of light emitted during a field period remains fairly independent of any ageing of the device stack.

This TTOM project is a first feasibility study into the use of optical feedback in the pixel of a P-OLED/CMOS microdisplay. In this case we have attempted to establish by estimation, calculation and simulation whether optical feedback is a feasible approach. For example, can the necessary functionality be deployed in the required pixel area, can an appropriate amount of light be injected into the feedback loop etc. The results of the project are sufficiently positive that they will be used in preparing a proposal for follow-on research on a much more substantial basis. This will include experimentation that has been beyond the scope of effort, cost or timescale available under TTOM.

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