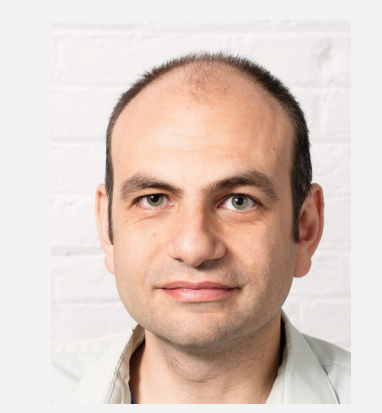
Thin film electronics for sustainable displays

Abstract

Displays represent a significant environmental challenge both through their carbon footprint and as a source of e-waste in today's economy. About 2/3 of a typical display's carbon footprint is attributable to the use of the unit, and the remaining 1/3 is generally in device production. Mitigating this impact requires an integrated consideration of the materials used (especially glass substrates), the processes required for display fabrication, and the choices made in the display circuitry and drive algorithms.

In this presentation two approaches to improving display life cycle and ecology will be presented, examining both current technology and next generation displays. The first is the use of low carbon impact substrates and the use of printable semiconductor materials in traditional display technologies. We have been developing an environmentally sensitive active-matrix liquid crystal display which replaces many of the materials with printable and recyclable alternatives. Looking at the future, we have also been developing an approach for next-generation microLED displays with an eye to total cost and energy efficiency. An approach using a monolithically integrated thin film transistor technology will be discussed and the impact on both material use in production and carbon footprint in operation will be presented.



Ioannis (John) Kymissis is the Kenneth Brayer Professor of Electrical Engineering at Columbia University and Vice Dean for Infrastructure and Innovation of the Fu Foundation School of Engineering.

He graduated with his SB, M.Eng., and Ph.D. degrees from MIT. His M.Eng. thesis was performed as a co-op at the IBM T.J. Watson Research Lab on organic thin-film transistors, and his Ph.D. was obtained in the Microsystems Technology Lab at MIT, working on field-emission displays. After graduation, he spent three years as a postdoc in MIT's Laboratory for Organic Optics and Electronics, working on a variety of organic electronic devices, and also as a senior engineer for QD Vision (later acquired by Samsung Electronics) working on the integration of quantum dots in displays. He joined the faculty at Columbia University in electrical engineering as an assistant professor in 2006, and served as chair of the department from 2020-2024. He is a fellow of the IEEE, Optica, the Society for Information Display (SID), SPIE, and the National Academy of Inventors and is currently the president of SID.