MRS

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June 23, 1998

ONR 312
Dr. Yoon S. Park
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Ballston Tower One
800 North Quincy St
Arlington VA 22217-5660

Dear Dr. Park:

RE: ONR Grant N00014-98-1-0536

Enclosed are four (4) copies of the final technical report for Symposium G, "Science and Technology of Organic Electroluminescent Devices," held at the 1998 MRS Spring Meeting.

This symposium had strong attendance, and MRS appreciates ONR's contribution towards its success.

Sincerely,

Donna J. Gillespie

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Symposium Funding Administrator

Enclosure

cc: Defense Technical Information Center (w/enc)
Grant Administrator, Regional Chicago Office (wo/enc)

Technical report for ONR Grant #N00014-98-1-0536

1998 Spring MRS Symposium G

Part I: *Symposium Objective*

Part II: *Technical Highlights*

1998 Spring MRS Meeting, San Francisco, CA
April 13-17, 1998

Symposium G: Science and Technology of Organic Electroluminescent Devices

Symposium organizers

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Symposium Objective

Organic electroluminescent (EL) devices promise a new and exciting form of emissive display technology. Unlike many of the existing display technologies, organic EL devices offer a path to low cost, large area emissive displays by virtue of their simple fabrication techniques.

This symposium hopes to bring together scientists and engineers from the academic and industrial world to address the critical challenges the field is facing in the area of materials synthesis, device physics, engineering and display fabrication. Both types of devices made from small molecules and polymers will be covered. Focused sessions include electrochemical cells and prospects for organic laser diodes.

Technical Highlights

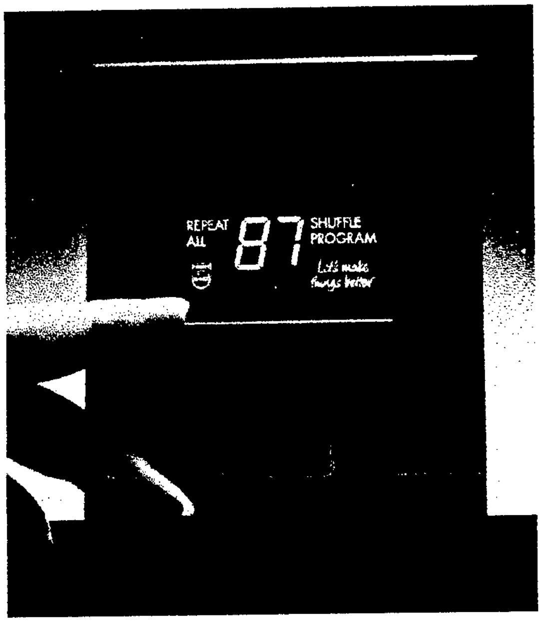
The field of organic light-emitting diodes (OLED's) is progressing very rapidly and that was very clear in the symposium G with title Science and Technology of Organic Electroluminescent Devices. The thrust of many papers was on high performance electroluminescent polymers and the improvement of polymer OLED lifetime and power efficiency. Furthermore, emphasis was given on the understanding of device physics and on novel patterning schemes for multicolor display applications.

Herman Schoo from Philips Research Laboratories announced that Philips Electronics will establish a new business unit in Heerlen, Netherlands for the development, manufacture and sales of light emitting polymers with the first products aiming at backlights and small segmented displays. That decision was enabled due to the enormous increase in performance of polymer LED's. Philips together with Uniax presented an orange emitting polymer LED with 3-4 lm/W power efficiency and a measured room temperature (RT) lifetime (with minimal degradation) of 8500 hours at the luminance of 20 cd/m^2. From high temperature data, the extrapolated RT half-life was found to be 40,000-50,000 hours. A green emitting polymer LED with 17 lm/W at 3.2 V and luminance of 100 Cd/m^2 was also reported by the same team.

Ed Woo from Dow Chemical presented devices based on a new family of conjugated polymers and copolymers containing 9,9-disubstituted fluorene as a key component. Single and bilayer LED's with efficiency higher than 6 lm/W were reported. The Dow Chemical group has managed to improve the polymerization process, which now yields high molecular weight and high purity polymers from which tough, flexible, free-standing films can be obtained. Polymers and copolymers of vastly different chemical, physical, and electronic properties are accessible via this technology, enabling the construction of efficient and long-lived devices through careful matching of polymer energy levels and transport properties. Siemens and Hewlett-Packard showed examples of monochrome pixelated displays based on fluorene copolymers.

James Sturm from Princeton University emphasized the possibility of self-heating in large displays driven by passive matrix and pointed out the need for active matrix drivers. However in large-scale active matrix OLED displays, a critical issue is the inevitable device to device manufacturing variations in large-area TFT processes, which can lead to undesirable spatial variation in pixel brightness. In a joint project between Samoff Corp., Princeton University, Eastman Kodak, and Planar America, a self-compensating intelligent 4-transistor pixel has been developed which successfully overcomes the effect of such TFT variations.

Yang Yang from UCLA presented a patterning scheme by using an ink-jet printer to create a polymer based LED. Both Yang Yang and James Sturm and their teams showed schemes where inkjet printing can be used to deposit red, green and blue devices on a single substrate without the need for masking or etching of the emitting materials. For now, only single color single pixel displays have been shown by the UCLA group. Full color displays made in one simple ink-jet printing step will have to wait until water-soluble light emitting polymers are available.



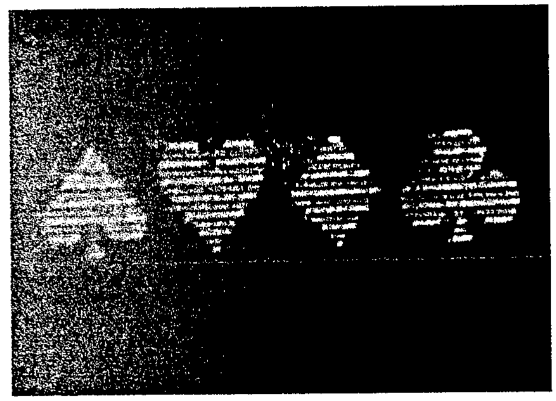


Fig. 1 The first polymer light emitting segmented display under development by Philips Electronics, Netherlands. (Courtesy, Philips Electronics, Netherlands)

Fig. 2 Electroluminescent complex single pixel image made by ink-jet printing (Courtesy, Yang Yang, UCLA)