

Organic device in ubiquitous information society

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As information society is becoming more advanced, more needs are demanded for ubiquitous information household appliances, which allow users to access information at any time from any place. Among others, organic devices, as represented by organic electroluminescent (EL) devices and the thin film transistors (TFT) are expected to apply more for soft and flexible information electronic devices such as electronic newspapers. Organic materials have “light and soft” characteristics in contrast to non-organic materials. The organic EL display has been already commercialized and used for cell phones and displays for digital cameras.

Development of organic EL devices that capture outside light efficiently

Our research group is working on development of “photo-responsive organic EL devices” by putting a layer of a photoelectric transducer (organic photo conductor (OPC)) into an organic EL device. Emitting light to that device, photo carriers are produced at the OPC layer. The carriers are then injected into the organic EL layer, thereby improving its intensity.

Figure 1 illustrates that light radiation. Emitting near-infrared light (780 nm) to a device with 3–6 V applied, only the emitted portion radiates green light (in the switching

mode: left side of Fig. 1). Applying 6 V or more to the device, the entire device radiates green light and the radiation intensity increases at the place where the near infrared light is irradiated (in the amplification mode: right side of Fig. 1). In the future, we anticipate developing a “lighting apparatus responding to brightness” by having a higher sensitivity around the visible range of the OPC layer so that it can recognize the environmental brightness. Consequently, it will be irradiated with low intensity in a dark place and with high intensity by absorbing light in clear weather outside, for example.

Development of n-type organic TFT of high performance by applying spin-coating method

In addition, organic TFT is now receiving attention for use in RF-ID tag or organic EL, which is driven by organic TFT circuit. Particularly, the development of organic semiconductors that are soluble in solvents is becoming more popular recently because, if done successfully, it would allow production of organic TFTs with a large area at low cost by the associated printing law.

Our research group newly developed the C60 derivatives(C60MC12). Using an alkyl chain, which can become soluble in the solvent, we can produce a highly crystallized thin film

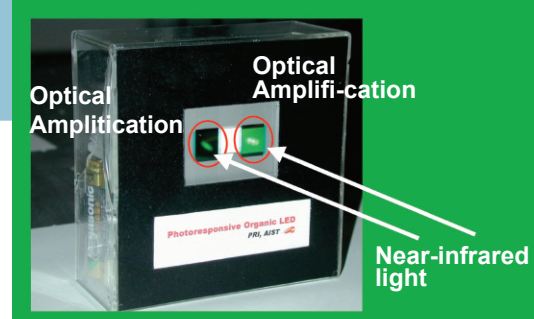


Figure 1: Photo of light-responsive organic EL device when illuminated

using the spin-coating method. Figure 2 shows characteristics of the C60MC12-TFT. The electron mobility is $0.09 \text{ cm}^2/\text{Vs}$, which shows the best value of all the n-type organic TFTs produced by the spin-coating method.

Based on this success, we accomplished the same level of electron mobility as of p-type semiconductors (polythiophene) that were made using the spin-coating method, which means that both p-type and n-type of organic semiconductors became available. As a consequence, not only has that circuit designing become more flexible, but organic devices can also now be produced even on a soft and flexible base like plastic, which is allowed by the new printing law. It is expected that the actual use of in the real world would be accelerated by the use of this new technology.

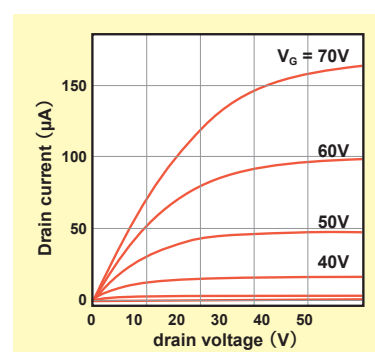


Figure 2: Characteristics of C60MC12-TFT produced by spreading method

- Create a personal network and a research community across fields of technical aspects or social life aspects with respect to the five senses;
- Exchange information regarding five senses technology and its needs;
- Plan and promote various research and development projects regarding five senses technology;
- Establish a vision for the five senses industry;
- Investigate and advise on aspects of five senses technology and industry to work on a new promotion policy or to plan a new base creation.

Up to the end of December 2004, we have opened the forum five times with 800 participants in all. In addition, we have forum members of nearly 250 people from over 200 companies who have joined at present, meaning that cooperative activities made by industry and by academic and government organizations are steadily and passionately moving forward to support “Five Senses Industry” in its establishment and growth.

