There are many advantages of using a network of CNTs as electrode contacts for organic semiconductors. First, diluted CNT networks are partially transparent to the electric field and thus allow it to penetrate the contact region. Second, the one-dimensional form factor of CNTs gives rise to strong electrostatic effects at the electrode/semiconductor interface. Third, pristine CNTs, by virtue of their passivated graphene-like surface, do not readily form covalent bonds with organic semiconductors, leading to a low interface state density at the junction. This makes the interface ideally suited for controlling the barrier that forms at the contact as a result of the mismatch between the Fermi level of the electrode and the affinity level of the organic semiconductor. Finally, the CNT network is transparent to light and can therefore be used as a transparent electrode.

It is important to mention that VOLETs differ from conventional FETs not only in design but also in operating mode. In fact, VOLETs function as p-type Schottky barrier transistors, in which the switching action occurs through a gate-induced modulation of the nanotube/organic injection barrier thickness, rather than through a gate-modulated channel conductance[6]. In addition, recent simulations by Rinzler and co-workers have demonstrated that the low density of states in CNTs (compared with metals) brings further contact modulation through changes in the contact barrier height by the gate field[8].

It is clear that combining CNT electrode technology with organic devices opens up a whole new range of possibilities for organic electronics. For instance, other groups have already used CNT electrodes to make better contacts for p-type, n-type and ambipolar organic transistors[11–13]. The groundbreaking demonstration of Rinzler and co-workers makes it clear that even higher levels of performance and device integration should be expected for organic light-emitting displays in the future. ❐

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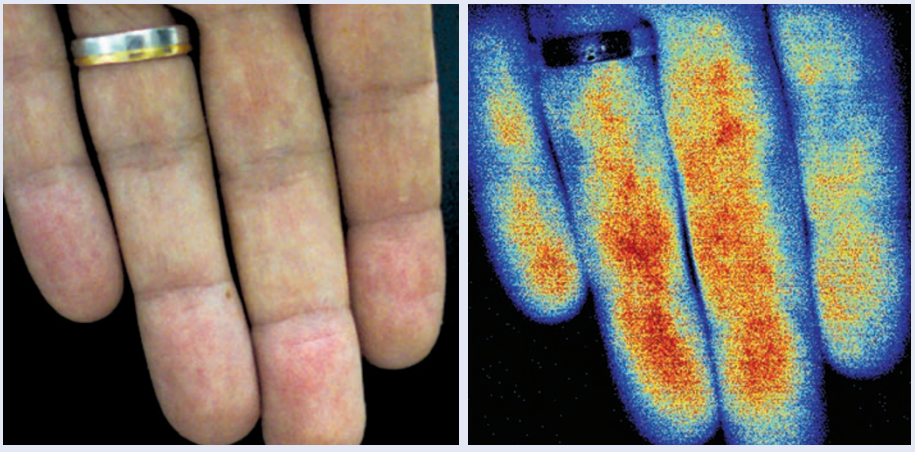
IMAGING

Mapping blood flow

Non-invasive techniques for measuring dermal blood flow are important for clinical diagnosis and the treatment of peripheral vascular disease. Although techniques such as scanning laser Doppler imaging and laser speckle contrast imaging are both suitable for this task, the former requires long mapping times and the latter needs *a priori* knowledge of the blood velocity distribution.

Marcel Leutenegger and co-workers from Switzerland have now demonstrated a scanning laser Doppler imaging scheme that can be used to measure large-area blood perfusion *in vivo* and in real time (*Biomed. Opt. Express* **2,** 1470–1477; 2011).

A scanning laser Doppler imaging instrument typically consists of a monochromatic light source with a long coherence length, a fast detector and hardware and software for analysing the detected signal. When light from the laser illuminates a tissue sample, part is statically scattered by the tissue's structure and part is dynamically scattered by the red blood cells flowing through the arteries and veins. The dynamically scattered light incurs a small wavelength shift due to the Doppler effect. Coherent mixing of the statically and dynamically scattered light causes intensity beating at a frequency in the kilohertz range for typical blood flow speeds of a few millimetres per second. The blood flow can then be mapped based on the detected power spectrum.



In their scheme, Leutenegger and co-workers used a 150 mW, 808 nm laser as the light source and a high-speed CMOS camera chip and powerful field-programmable gated array chip for processing the captured images in real time. The processing unit is designed in such a way that the pixel values of the CMOS sensor are read during integration of the next frame, which allows for almost uninterrupted sensor exposure.

The researchers imaged blood perfusion in an area of 50 cm^2 at 12–14 frames per second with 480 × 480 pixels per frame. The technique can be configured for smaller areas if a higher frame-rate is desired. The team also mapped the blood perfusion of human fingertips and skin samples of humans and small animals, which showed distinctive perfusion and/or microcirculatory responses. The researchers are confident that their approach will help assess health issues related to microcirculation.

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