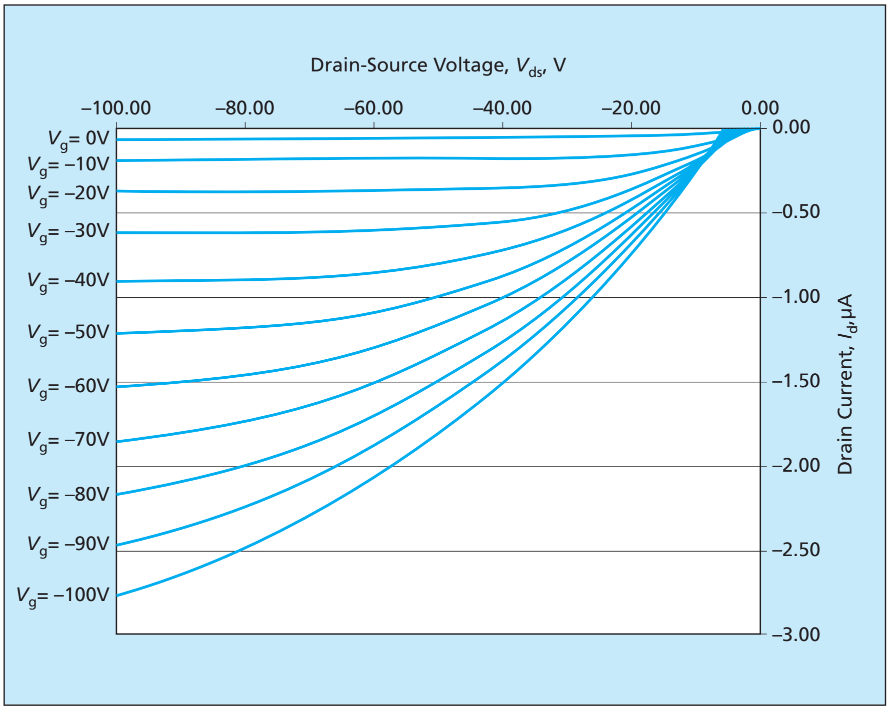

Figure 2. These **Current-Versus-Voltage Curves**, obtained from measurements on a device like that of Figure 1, are characteristic of a field-effect transistor.

paste was stencil-printed through the apertures using a metal squeegee, and the contacts were cured at 100 °C on a hot plate for 30 minutes. The P3HT material was then drop cast on the surface of the substrate, over the printed contacts. Contact was made to the cleaved wafer to form the gate. Contact was made to the drain and source carbon contacts through probes connected to micromanipulators. Device measurements were conducted on an HP 4145B semiconductor parameter analyzer, with the drain-source voltage varying from 0 to –100 V, and the gate bias varying from 0 to –100 V in –10 V steps.

As seen in Fig. 2, very good transistor curves are obtained from the devices, indicating clear field-effect phenomena, which demonstrates the effectiveness of the carbon-based contacts. In this case, a device with a channel length of 500 µm and a channel width of 5,000 µm was measured (multiple devices were characterized to verify repeatability of the data). Other device geometries are possible, as printed feature sizes down to 37 µm have been demonstrated using state-of-the-art thick-film stencil/screen printing techniques.

Enhancement of the drain-source current is clearly seen as a function of increasing gate bias in Fig. 2. In this case, an I_{on}/I_{off} ratio of 44 was determined at V_{ds} = –100 V, with V_g = 0 (I_{off}) and V_g = –100 V (I_{on}). A carrier mobility of $\mu \approx$ 0.007 cm^2/V-s was also estimated from the data.

This work was done by Erik Brandon of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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GaAs QWIP Array Containing More Than a Million Pixels

GaAs offers advantages over InSb and HgCdTe.

Goddard Space Flight Center, Greenbelt, Maryland

A 1,024 × 1,024-pixel array of quantum-well infrared photodetectors (QWIPs) has been built on a 1.8 × 1.8-cm GaAs chip. In tests, the array was found to perform well in detecting images at wavelengths from 8 to 9 µm in operation at temperatures between 60 and 70 K. The largest-format QWIP prior array that performed successfully in tests contained 512 × 640 pixels.

There is continuing development effort directed toward satisfying actual and anticipated demands to increase numbers of pixels and pixel sizes in order to increase the imaging resolution of infrared photodetector arrays. A 1,024 × 1,024-pixel and even larger formats have been achieved in the InSb and HgCdTe material systems, but photodetector arrays in these material systems are very expensive and manufactured by fewer than half a dozen large companies. In contrast, GaAs-photodetector-array technology is very mature, and photodetectors in the GaAs material system can be readily manufactured by a wide range of industrial technologists, by universities, and government laboratories.

There is much similarity between processing in the GaAs industry and processing in the pervasive silicon industry. With respect to yield and cost, the performance of GaAs technology substantially exceeds that of InSb and HgCdTe technologies. In addition, GaAs detectors can be designed to respond to any portion of the wavelength range from 3 to about 16 µm — a feature that is very desirable for infrared imaging. GaAs QWIP arrays, like the present one, have potential for use as imaging sensors in infrared measuring instruments, infrared medical imaging systems, and infrared cameras.

This work was performed by Murzy Jhabvala of **Goddard Space Flight Center** *and K. K. Choi of the U. S. Army Research Lab and Sarath Gunapala of NASA's Jet Propulsion Laboratory. For further information, contact the Goddard Innovative Partnerships Office at (301) 286-5810. GSC-14688-1*