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Lithography makes a connection for nanowire devices

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Researchers at Harvard University, US, have used a photolithography technique to set up interconnects to nanowire devices. The method uses a statistical approach to ensure that a high proportion of the nanowires connects to the electrodes - there is no need to link the two components individually.

"We believe this is the first reported bottom-up assembly and device integration approach that is fully scalable in terms of device density and area of coverage," Song Jin and Dongmok Whang told *nanotechweb.org*. "It provides a pathway for the development of highly functional and integrated nanosystems."

Jin, Whang and colleagues used a Langmuir-Blodgett technique to deposit nanowires over a large area with controlled alignment and spacing (see Nanowire arrays line up for future devices for details). They patterned the nanowires into small regions and then used photolithography to deposit arrays of metal electrodes.

The researchers set the electrode width to a value near to that of the average nanowire spacing. As a result, the local fluctuations in nanowire separation led "to an efficient formation of contacts". There was no need to align individual electrodes and nanowires, the researchers simply had to fix the position of each array of electrodes relative to each group of nanowires.

The team demonstrated the technique by making centimetre-scale arrays containing thousands of single silicon nanowire field-effect transistors. Typically, around 80% of the possible 3000 electrode connections were bridged by a nanowire.

"The massive arrays of nanowire transistor devices have high performance - a mobility of 300 cm^2/Vs - and unprecedented reproducibility," said Jin.

Jin says the technique also has the advantage of room-temperature processing, making it compatible with low cost and flexible glass and plastic substrates. "This approach can lead to near-term applications such as arrays of biological sensing systems and macroelectronics," he said. "In macroelectronic applications the scalable and large-area assembly and integration strategy makes the arrays of nanowire transistor devices suitable as the 'thin film transistor like' devices for information displays."

Now the researchers say they would like to assemble and integrate more complex structures, such as crossed nanowire arrays and arrays of distinct types of nanowire building blocks. That would enable nanowire memory arrays, programmable logic arrays, or "other diverse electronic and photonic nanosystems".

The scientists reported their work in *Nano Letters*.

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