

An important step toward molecular electronics

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Silicon microelectronics has undergone relentless miniaturization during the past 30 years, leading to dramatic improvements in computational capacity and speed. But the end of that road is fast approaching, and scientists and engineers have been investigating another promising avenue: **using individual molecules as functional electronic devices.**

Now a team of engineers at Northwestern University has become the first **to precisely align multiple types of molecules on a silicon surface at room temperature** -- an important step toward the goal of molecular electronics.

The results, which demonstrate patterning on a scale 10,000 times smaller than that of microelectronics, are published today (Sept. 27) as the cover story of the journal Applied Physics Letters (APL).

"We have demonstrated a strategy for intentionally positioning molecules, which is necessary for the construction of nanoscale systems such as molecular transistors or light-emitting diodes," said Mark C. Hersam, assistant professor of materials science and engineering, who led the research team. "Our process works at room temperature and on silicon, which suggests that it can be made compatible with conventional silicon microelectronics. Ultimately, we want to integrate with current technology, thus creating a bridge between microelectronics and nanoelectronics."

The nanofabrication process, called multi-step feedback-controlled

lithography, is useful for a variety of fundamental studies and for the construction and testing of prototype nanoscale devices that could be used in future technologies ranging from consumer electronics to biomedical diagnostics.

"Previously we were working with single molecules on silicon," said Hersam. "This new process enables us to build more complex structures. Plus, the technique is general and can be used with many different molecules, which increases its potential."

The researchers demonstrated their process using a custom-built ultrahigh-vacuum scanning tunneling microscope. With this tool, they constructed chains consisting of styrene and a molecule known as TEMPO and now are studying the electronic properties of this novel nanostructure.

Source: Northwestern University

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