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Nanomaterials Produce Heterogeneous Three- Dimensional El

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Researchers at the Frederick Seitz Materials Research Laboratory of the Univ have developed a new, experimentally simple approach for combining broad electronic materials into heterogeneously integrated systems with two or thr layouts on rigid or flexible substrates. The materials and techniques, publish 15 issue of Science, provide capabilities that can complement those achieval conventional methods.

The invention of the transistor was considered by many to be one of the greatest in history, ranking in importance with the printing press, automobile, and telephone. T by the Illinois team seeks to exploit the power of transistors in new ways.

“Important new types of electronic systems will rely on the ability to mix and match of semiconductor devices in three dimensional configurations on unusual substrate Rogers, a Founder Professor of Engineering at Illinois. “The circuits enabled by suc open up interesting application possibilities that lie beyond the scope of existing sir scale electronics.” Examples include electronic eye imagers, advanced communica area structural health monitors, and conformable sensor skins.

“We have developed a simple approach to combine disparate types of semiconduc dimensional, heterogeneously integrated (HGI) electronic systems,” added Rogers appointments in the departments of materials science and engineering, chemistry, computer engineering, mechanical science and engineering, and is also a research Institute for Advanced Science and Technology.

The process starts with the synthesis of semiconductor nanomaterials, in the form nanoscale ribbons, wires, tubes and bars, on specialized growth substrates. Repea printing technique that uses soft, elastomeric ‘stamps’ with these nanomaterials as by device integration yields heterogeneously integrated electronics that incorporate these or other semiconductor nanomaterials on virtually any type of device substra inorganic materials to flexible plastics. Circuits built in this way offer electrical and r bendability) attributes that would be impossible to achieve using conventional, wafe to electronics.

A key feature of the strategy is that it occurs at room temperature, thereby enabling placed on unconventional substrates such as thin sheets of plastic.
“This work shows that it is possible to liberate high performance electronic devices semiconductor wafers and to integrate them onto surfaces and substrates that bett end applications,” explained Ralph Nuzzo, the William H. and Janet Lycan Profess coauthor on the paper.

The researchers report several demonstration systems that involve wide ranging ty including silicon MOSFETs, GaN HEMTs, GaAs diodes and even transistors that u

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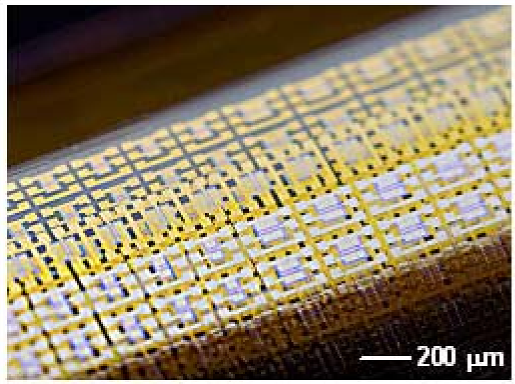
formed in various combinations on rigid as well as mechanically flexible substrates multilayer configurations. The figure shows an optical image of a three layer stack transistors that incorporate printed single crystal silicon nanoribbons. This system u sheet of plastic as a substrate. The image shows the circuit bent around a cylindric its mechanical flexibility.

Besides these examples, the researchers believe that the same methods will enabl optical, sensing and micromechanical devices with these electronics to yield compl systems.

Three dimensional stack of field effect transistors on a thin sheet wrapped around a cylinder. This system uses printed arrays of sir nanoribbons for the semiconductor.



Three dimensional stack of field effect transistors on a thin sheet of flexible plastic, wrapped around a cylinder. This system uses printed arrays of single crystal silicon nanoribbons for the semiconductor.

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