Scientists use 'hydrogen blisters' to lower the cost of electronic devices

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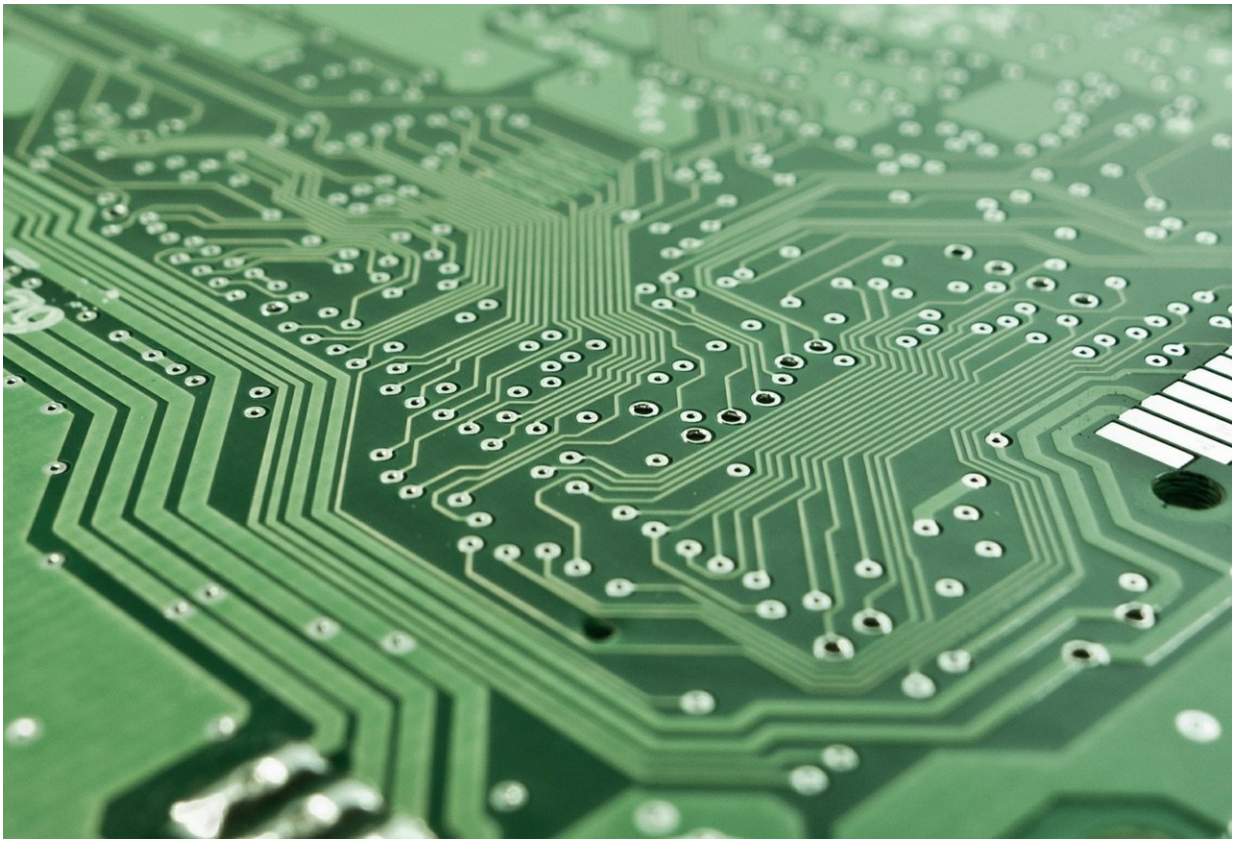

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In cooperation with French and Greek researchers, scientists from the National Research Nuclear University MEPhI have found a simple way to lower the production costs of nano-electronics through controlled

deformation of nanotubes and other tiny objects. Their findings were published in *Nanotechnology*.

Musicians tighten their instrument strings to obtain a certain sound quality. A similar method is used in carbon nanoelectronics—scientists use deformed carbon nanotubes to make wires, diodes, transistors, and many other components. However, these carbon "strings" are 100,000 times thinner than a human hair, so scientists need to develop complicated methods to strain them.

"The existing methods are aimed at creating single samples of strained nanotubes; this makes them too expensive for industrial applications," said Konstantin Katin, assistant professor at the MEPhI Institute of Nanoengineering in Electronics, Spintronics, and Photonics. "This is why we came up with an alternative designed for large production volumes that involves depositing carbon nanotubes on the supporting wafer pre-implanted with hydrogen and helium ions."

Upon thermal annealing, these ions turn into gas-filled platelets that grow to form a blister on the surface of the wafer, Katin explained. This blister causes the deformation of the nanotube. By changing the temperature, scientists can control the size of the blister and, therefore, the deformation of the nanostructure.

"Our method is applicable to not just carbon nanostructures, but to a wide range of nanostructures," said another Institute employee, assistant professor Mikhail Maslov. "The electronic properties of most low-dimensional systems change with the application of tensile strain."

MEPhI researchers believe this development will make the production of many basic components used in nanoelectronic circuits less expensive.

Today, the researchers are testing the efficiency of hydrogen blisters on

other materials (such as graphene flakes and carbon peas) and plan to patent their developments.

More information: V S Prudkovskiy et al. A bottom-up approach for controlled deformation of carbon nanotubes through blistering of supporting substrate surface, *Nanotechnology* (2018). DOI: 10.1088/1361-6528/aacc5d , iopscience.iop.org/article/10. … 088/1361-6528/aacc5d

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