

[Home](#)[News](#)[Nano Databases](#)[Nano Catalog](#)[Nano Jobs](#)[Resources](#)[Introduction to Nanotechnology](#)

Posted: Apr 13, 2018

Individual impurity atoms detectable in graphene

(Nanowerk News) Graphene is made of a two-dimensional layer of carbon atoms arranged in a hexagonal lattice. The strong bonds between the carbon atoms make graphene extremely stable yet flexible. It is also an excellent electrical conductor through which electricity can flow with almost no loss.

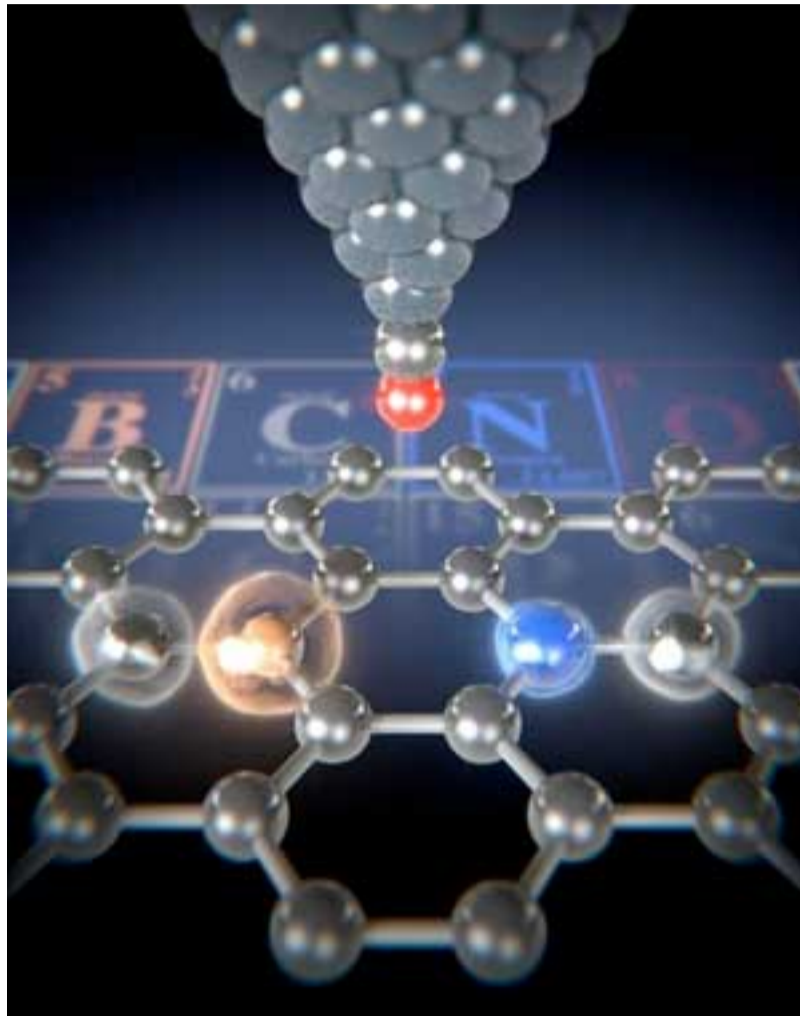
Graphene's distinctive properties can be further expanded by incorporating impurity atoms in a process known as "doping". The impurity atoms cause local changes of the conduction that, for example, allow graphene to be used as a tiny transistor and enable the construction of circuits.

Targeted incorporation

In a collaboration between scientists from the University of Basel and the National Institute for Material Science in Tsukuba in Japan, Kanazawa University and Kwansei Gakuin University in Japan, and Aalto University in Finland, the researchers specifically created and examined graphene ribbons containing impurity atoms (*Science Advances*, ["Multiple heteroatom](#)

substitution to graphene nanoribbon").

They replaced particular carbon atoms in the hexagonal lattice with boron and nitrogen atoms using surface chemistry, by placing suitable organic precursor compounds on a gold surface. Under heat exposure up to 400° C, tiny graphene ribbons formed on the gold surface from the precursors, including impurity atoms at specific sites.



Using the atomic force microscope's carbon monoxide functionalized tip (red/silver), the forces between the tip and the various atoms in the graphene ribbon can be measured. (Image: University of Basel, Department of Physics)

Measuring the strength of the atoms

Scientists from the team led by Professor Ernst Meyer from the Swiss Nanoscience Institute and the University of Basel's Department of Physics examined these graphene ribbons using atomic force microscopy (AFM). They used a carbon monoxide functionalized tip and measured the tiny forces that act between the tip and the individual atoms.

This method allows even the smallest differences in forces to be detected. By looking at the different forces, the researchers were able to map and identify the different atoms. "The forces measured for nitrogen atoms are greater than for a carbon atom," explains Dr. Shigeki Kawai, lead author of the study and former postdoc in Meyer's team. "We measured the smallest forces for the boron atoms." The different forces can be explained by the different proportion of repulsive forces, which is due to the different atomic radii.

Computer simulations confirmed the readings, proving that AFM technology is well-suited to conducting chemical analyses of impurity atoms in the

promising two-dimensional carbon compounds.

Source: Universität Basel



Subscribe to a free copy of one of our daily [Nanowerk Newsletter Email Digests](#) with a compilation of all of the day's news.

Precision Nanomaterials Printer



 sonoplot

These articles might interest you as well:



Research News

(click here for Business News)

Valleytronics discovery could extend limits of Moore's law
Seeing how next-generation batteries power-up

Posted: Apr 14, 2018

Posted: Apr 13, 2018

Artificial intelligence accelerates discovery of metallic glass
Individual impurity atoms detectable in graphene

Posted: Apr 13, 2018

Posted: Apr 13, 2018

Psst! A whispering gallery for light boosts solar cells
Similar charges are attracted to each other

Posted: Apr 13, 2018

Posted: Apr 13, 2018

Oxide separation anxiety
A core-shell nanotube array for artificial photosynthesis
Tiny structures - huge impact

Posted: Apr 13, 2018

Posted: Apr 13, 2018

Posted: Apr 13, 2018

Observing biological nanotransporters
Mimicking nanoscale natural movements with the help of DNA origami

Posted: Apr 13, 2018

Posted: Apr 13, 2018

Anomalous and topological Hall effects can be controlled by an electric field
One string to rule them all

Posted: Apr 13, 2018

Posted: Apr 12, 2018

Could holey silicon be the holy grail of electronics?

Posted: Apr 12, 2018

One step closer to using nanoporous graphene membranes as smart filters and sensors

Posted: Apr 12, 2018

Mechanism of oxidative unzipping of multiwall carbon nanotubes to graphene nanoribbons

Posted: Apr 12, 2018

How advanced nanotechnology can improve cancer care

Posted: Apr 12, 2018

Researchers find combination for small data storage and tinier computers

Posted: Apr 12, 2018

Wiggling atoms switch the electric polarization of crystals
Nanotechnology wearable self-charging power units

Posted: Apr 12, 2018

Posted: Apr 12, 2018



Scientists unlock path to use cell's own nanoparticles as disease biomarkers

Posted: Apr 12, 2018

The future of ultrafast solid-state physics Form damages function and magnetism suffers

Posted: Apr 12, 2018

Posted: Apr 12, 2018

Tiny probe can see and take body temperatures Chaos makes quantum sensors work more precisely

Posted: Apr 12, 2018


Posted: Apr 11, 2018

[...MORE NANOTECHNOLOGY RESEARCH NEWS](#)

Nanotechnology

Never miss an article!

Subscribe to one of our newsletters for the topic of your choice and get all new posts by email once a day. No spam ever. Promise!

 Sign me up!

The contents of this site are copyright ©2018 Nanowerk. All rights reserved.