

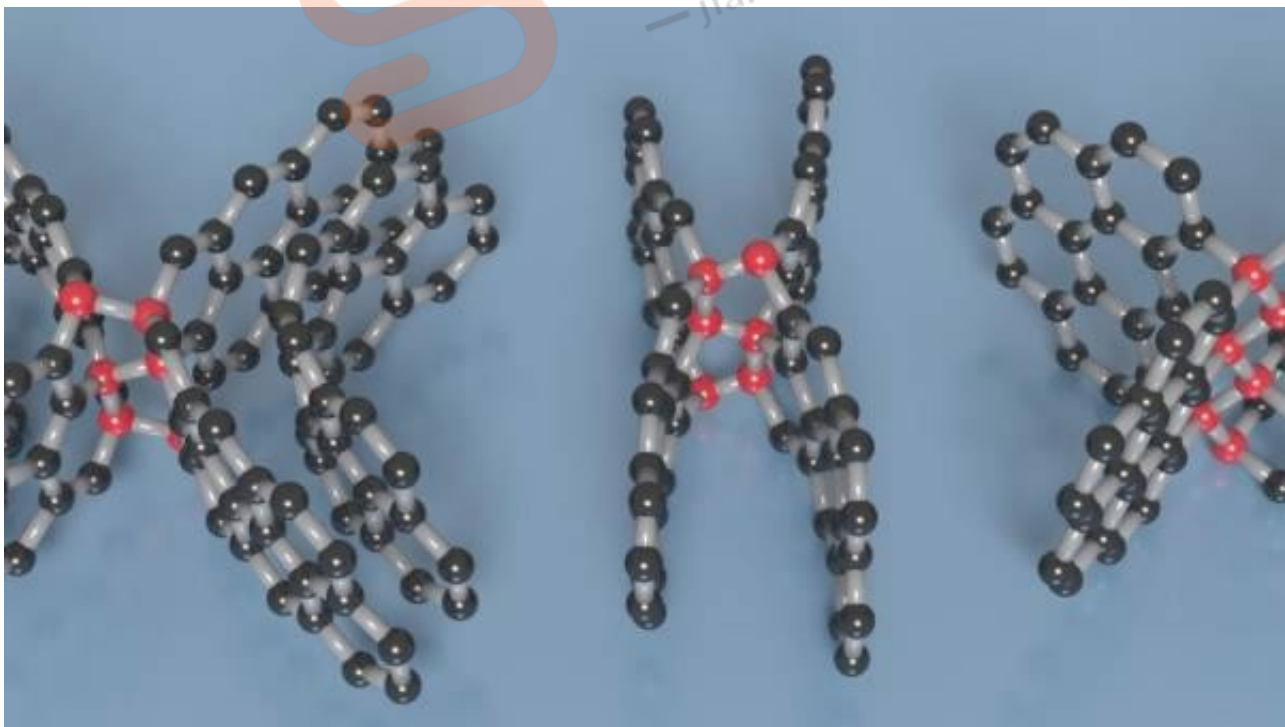
《Elastic yet hard as diamond: Scientists develop new carbon f》

Chinese and American scientists have jointly developed a form of ultra-strong, lightweight carbon that is as hard as a diamond yet elastic like rubber and electrically conductive.

"In simple terms, the material combines the best properties of graphite- and diamond-like forms of carbon," said study co-lead author Zhao Zhisheng, a professor at Yanshan University in China.

"This combination of properties is useful for many potential applications, such as military armor and aerospace."

The findings were published this week by the US journal Science Advances.



Visualization of the different types of diamond-like linkages (red spheres) formed at curved surfaces or between the layers of graphene (black spheres) in this new type of

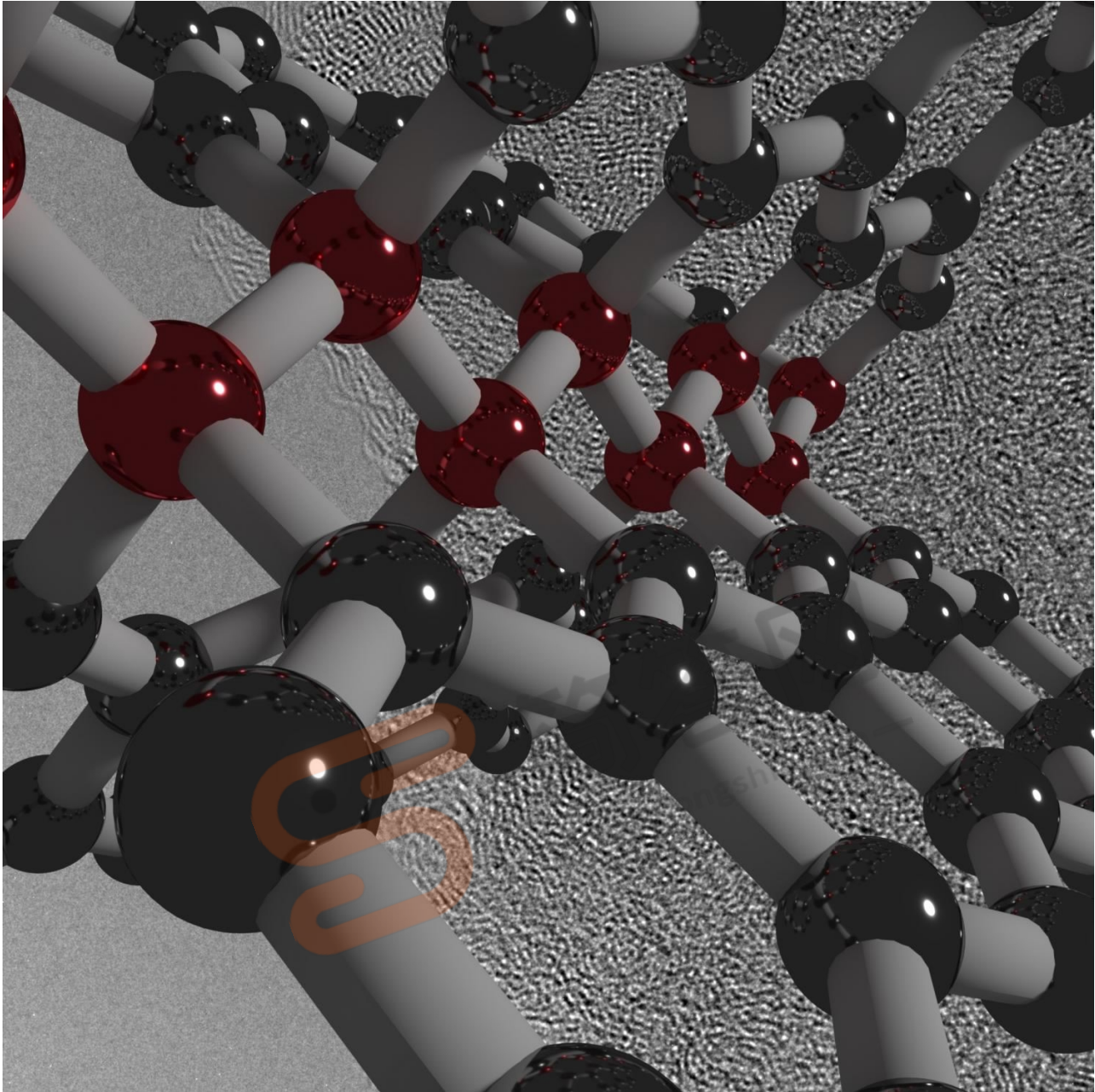
compressed glassy carbon. /Yanshan University Photo

Carbon is an element of seemingly infinite possibilities as its flexibility enables it to form different types of chemical bonds and thus exhibit a variety of fascinating structures.

According to Zhao, pressure is an effective tool to control this chemical bonding and induce so-called phase transformations.

For example, under high-pressure conditions, soft graphite transforms into diamond, the hardest material known.





Visualization of ultra-strong, hard and elastic compressed glassy carbon. The illustrated structure is overlaid on an electron microscope image of the material. /Yanshan University Photo

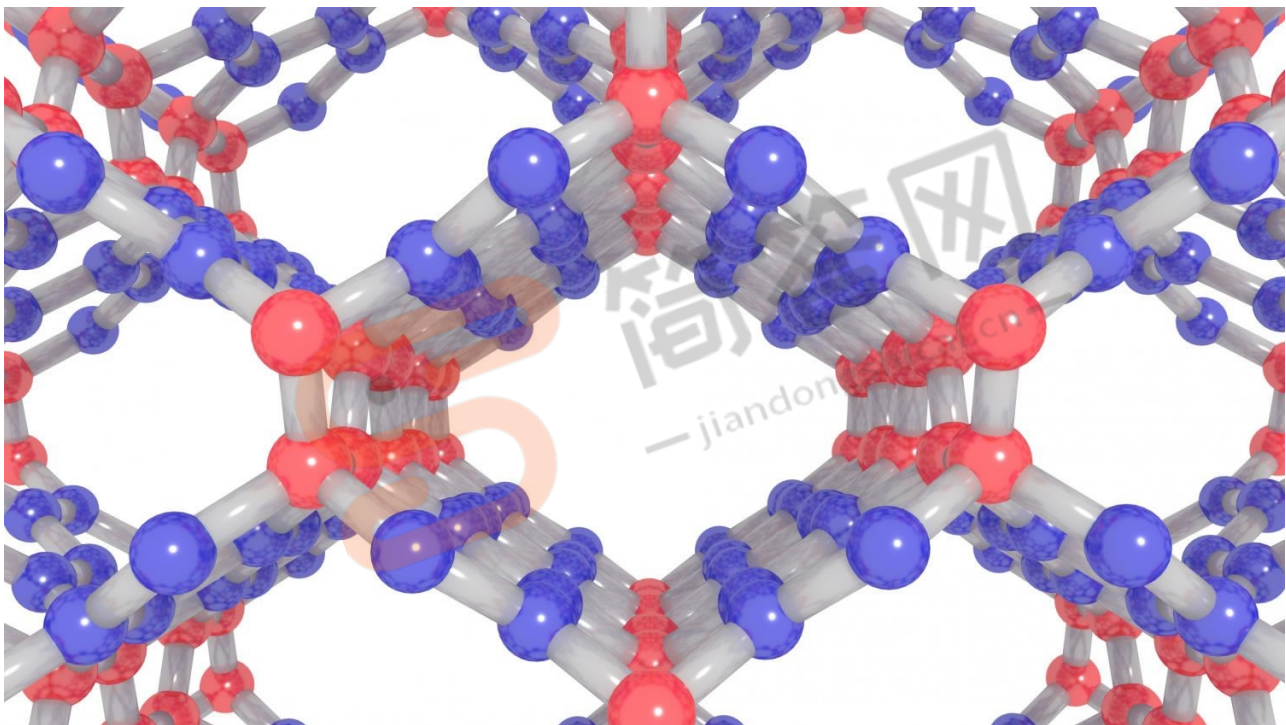
In the new study, scientists pressurized and heated a structurally disordered form of carbon called glassy carbon to create the new form of carbon.

"The process is similar to converting graphite into diamond, however, in our new

approach, the temperature used is not high enough to produce diamond," Zhao said.

"The resulting compressed glassy carbon exhibits exceptional hybrid properties in that it is lightweight, ultra-strong, very hard, elastic and electrically conductive."

Specifically, the compressed glassy carbon is more than two times stronger than commonly used carbon fibers, cemented diamond, silicon carbide and boron carbide ceramics.



View through the compressed glassy carbon. Graphene - like sheets (blue spheres) are cross-linked at diamond - like nodes (red spheres). /Yanshan University Photo

It also has high hardness compared with commonly used ceramics, conducts electricity and simultaneously exhibits a robust elastic recovery that is higher than shape memory alloys and organic rubber.

"Our future work will continue to develop this methodology and create new structural

materials with high strength, hardness and elasticity," said Zhao. "Our ultimate goal is to obtain the extremely strong and super-hard materials with super-elasticity."

The findings also included researchers from the Carnegie Institution of Washington, and Shanghai-based Center for High Pressure Science and Technology Advanced Research, the University of Chicago and the Pennsylvania State University.

(Source: Xinhua)

