

# Scientists create the world's best heat-resistant material, which can be used for spacecraft

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The reusable spacecraft will help the aerospace industry in general and space exploration in particular save more costs and can be more widely available - that's why the Aviation agencies are always looking for ways to accelerate the process of researching and developing them. However, these spacecraft are constantly exposed to very high temperatures every time they exit and return to Earth's atmosphere. Creating materials that can withstand temperatures like hell is a real need.

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The material previously held the title of "the most heat-resistant material" tested in 2016 by a research team from Imperial College London. Using laser heating techniques to test materials at very high temperatures, they calculated that a chemical compound made of hafnium - a transition metal, and carbon, had a melting point. the highest ever recorded. Their findings showed that hafnium carbide melted at about 4,000 degrees Celsius.

Before the discovery of the unbelievable melting point of hafnium carbide, researchers at Brown University used computer modeling techniques and made a prediction that a material made of hafnium, carbon, and nitrogen would have had ability is the world's best heat resistant material. Their simulated results show that the material will melt at more than 4,100 degrees Celsius, or nearly two-thirds of the surface of the Sun.

Knowing the predictions of the Brown researchers, NUST scientists planned to make hafnium carbonitride and conduct a test of it to compare it with hafnium carbide.

To create the new material, they put powder and carbon hafnium involved in a high-energy collision reaction with the balls inside a cylindrical grinder called a "ball mill". Ball mills are often used in the ceramic manufacturing process to grind materials into uniformly small particles. Following the high-energy ball milling reaction, the scientists burned a mixture of hafnium and carbon particles collected in a nitrogen atmosphere.



A plate of hafnium carbonitride

The samples of hafnium carbide and hafnium carbonitride are then placed on graphite plates for testing in a vacuum. When heated with a battery with molybdenum electrodes, the scientists found that the melting point of hafnium carbonitride is higher than that of hafnium carbide.

Because the melting point of hafnium carbonitride is very high - more than 4,000 degrees Celsius - one cannot accurately measure it in a laboratory. Future tests will use laser technology to determine the exact number, such as the one used by Imperial College London to determine the melting point of hafnium carbide.

The material's heat resistance, as well as its mechanical rigidity, make it a promising candidate for use in the fabrication of parts of a spacecraft - things that are constantly in contact with the environment. highest temperatures on the planet, such as the bow, propulsion, and wings. In addition, researchers plan to test hafnium carbonitride under ultrasonic conditions.

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