Physicists create a high-strength material for the aerospace and engineering industries

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Credit: Tomsk State University

A team of the Laboratory for Physics of High-Strength Crystals (Russia, Tomsk State University) has developed a new high-strength material based on iron to improve the quality of actuating mechanisms and sensors for mechanical engineering, aerospace, and other industries. The results of their study were presented at the international conference Alloys with Shape Memory Effect (St. Petersburg).

"The most widely known and used alloy with shape memory is nickel titanium. In our laboratory, we were the first to create monocrystals of iron-based alloys, especially iron-nickel-cobalt-aluminum, and the fifth element may be titanium, niobium, or tantalum. These alloys can

compete with nickel titanium," said Yury Chumlyakov, head of the laboratory.

In particular, iron-based alloys created at TSU have greater reversibility than nickel titanium—that is, they exhibit a high ability to recover their shape after deformation. The alloys based on iron have a reversible change in shape of about 15 percent, and nickel titanium alloys have about 10 percent. Thus, the sensors and actuators of the iron-based alloys will work effectively as mechanisms that they drive. This result was achieved through a special heat treatment—a technology for which scientists of the laboratory have already obtained a patent.

The iron-based alloys have high strength. This is important for practical use in devices that must withstand high external loads, such as the aerospace and engineering industries. The laboratory employees emphasized that the sensors and executive devices constructed from the new iron-based alloy will not only be stronger but also cheaper than nickel titanium. Thus, the use of iron-based alloys can reduce the cost of production of household equipment, fire alarm sensors, connecting elements for aerospace and automotive engineering, and other devices. The laboratory plans to continue the study of iron-based alloys.

Provided by Tomsk State University