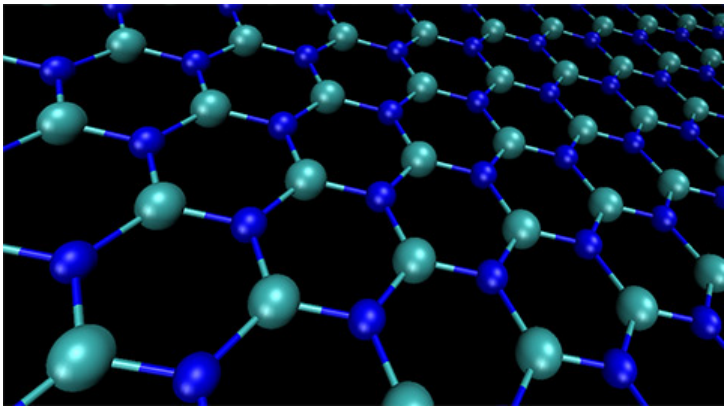
Scientists of SibFU have established new properties of vanadium nitride

Scientists of Siberian Federal University predicted the possible existence of two new two-dimensional metastable forms of vanadium nitride: t-VN and h-VN, which have strong ferromagnetic properties. The predicted structures have prospects in creating low-dimensional spintronic nanodevices of a new generation. The results of the study are published in "Journal of Physical Chemistry Letters".



Vanadium nitride is extremely important in modern technology. The main areas of its application are the production of special steels, which have increased strength and corrosion resistance. In addition, this material has superconducting properties and is used to create chemical condensers.

According to the first author of the publication of the research engineer SRD (Scientific Research Department) SibFU **Artyom Kuklin**, in the new work the scientists studied the stability, electronic and magnetic properties of two-dimensional lattices of vanadium nitride by the method of the density functional theory.

In contrast to the method of obtaining graphene, the authors used the so-called "bottom-up" method to synthesize the two-dimensional VN lattices predicted by them. The essence of this method consists in the controlled deposition of atoms of matter on the surface of a pre-selected material.

"*Taking into account the fact that not all two-dimensional materials can be separated from the surface on which the synthesis takes place, for one of the VN polymorphs we proposed the use of MoS2 molybdenum sulphide, which, as it turned out, does not critically affect the main advantages of the VN monolayer. Consequently, the obtained heterostructure also has prospects of using without separating the VN monolayer,*" — he said.

Thus, the scientists managed to find out that, in contrast to the crystalline vanadium nitride, which is a superconductor at low temperatures, these materials have strong ferromagnetic properties that can manifest themselves even at high temperatures, which is extremely rare in low-dimensional systems. In this case, t-VN has a degree of spin polarization of 99.9 %, and h-VN exhibits the properties of a magnetic (spin) semimetal, which is a positive feature while using these materials to create ultra-thin nanoelectronics elements based on spin charge transfer, for example, spin transistors.

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