

NEWS RELEASE 14-AUG-2024

# The experimental discovery of antimony polyhydride superconductor with Tc up to 116K

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Researchers at Institute of Physics Chinese Academy of Sciences(IOPCAS) report the discovery of superconductivity (SC) with  $T_c \sim 116$  K in new antimony polyhydride  $SbH_4$ , which has the second highest  $T_c$  among the covalent bonding dominated polyhydrides. The paper was published in *National Science Review* 11, nwad241 (2024).

The experimental discovery of SC with  $T_c \sim 203$  K in  $SH_3$  has sparked great enthusiasm to exploring new high-temperature superconducting polyhydride. Recently, polyhydride superconductor exploration mainly focuses on the elements with low electronegativity, such as rare-earth and alkaline-earth metals, and near room temperature SC with  $T_c > 200$  K has been found in the ion bonding dominated polyhydrides of lanthanum, yttrium, and calcium, respectively. However, there have been few experimental reports on polyhydride superconductors with covalent bonding.

In the main groups from IIIA to VIIA, most of the non-metallic elements have high electronegativity and usually form covalent bonding with hydrogen. Therefore, the research team led by Prof. Changqing Jin from IOPCAS try to explore new polyhydride superconductors with covalent bonding among the non-metallic elements. The diamond anvil cell combined with laser heating technique was used to synthesize the polyhydride samples under high pressure and high temperature conditions. *In-situ* high pressure transport measurements were performed to study the SC properties. Currently, they have successfully synthesized antimony polyhydride and found that the sample shows superconducting transition at 116 K under 184 GPa. It is proposed that the superconducting phase possibly arises from the  $P6_3/mmc-SbH_4$ . In the  $SbH_4$  lattice, the shortest H-H length forming conducting path is 1.73 Å, which is significantly larger than the typical value of 1.0-1.2 Å in ion bonding dominated polyhydride superconductors. Their results suggest that hydrogen atoms with moderate distance could be metallized and realize superconductivity via the formation of metallic covalent bonding with the second element.

The study entitled "Superconductivity with  $T_c$  116 K Discovered in Antimony Polyhydrides" was published in *National Science Review* 11, nwad241 (2024) at <https://doi.org/10.1093/nsr/nwad241>.

For more details pls visit the web at <http://uhp.iphy.ac.cn>

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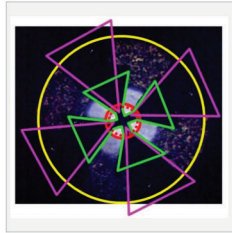


IMAGE:  
THE IMAGE OF THE SAMPLE CHAMBER & ELECTRODES ASSEMBLY IN A DIAMOND ANVIL CELL.

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