Structural study of 200-K superconductivity in compressed hydrogen sulfide

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After finding superconductivity in 100 years ago, "room-temperature" superconductor has been a long-fascinated target for physicists. Superconductivity above 200K was recently reported in the highly compressed hydrogen sulfide (H_2S) [1].

The crystal structure of the superconducting sulfur hydride systems was studied by using the synchrotron x-ray diffraction at room temperature and the superconducting temperature. H_2S and D_2S were compressed to 150 GPa in DAC with the same process with ref 1, and cooled down to 10 K in the cryostat in the x-ray diffractometer in SPring-8/BL10XU. The resistivity was monitored at all cooling process. The critical temperature and zero resistivity were observed around 180 K, and the collected x-ray diffraction data showed bcc-structure of sulfur which corresponds to the formation of H_3S at high pressure [2]. The formation of H_3S is good agreement with the theoretically predicted structures of *R*3m and *I*m-3m [3]. No structural difference was observed between at 10 K and room temperature.

High-temperature superconductivity at room temperature is theoretically predicted in metallic hydrogen of the solid phase at the very high pressure exceeding 500 GPa, but the hydrogen-originate superconductivity can be expected in the hydrogen-rich system which contains a large amount of hydrogen (such as hydrogen storage alloys and hydrocarbons). This result may lead us to a discovery of possible higher- temperature superconductivity in other hydrogen-rich systems.

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Bibliography

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