METALLIZATION OF ALUMINUM HYDRIDE AlH_3 AT HIGH MULTI SHOCK PRESSURES

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Aluminum hydride α-AlH_3 (alane) is a solid with very large hydrogen content of 10.1% by weight. Aluminium hydride is a promising additive to rocket fuels and high explosives and so need for knowledge of its properties under high pressures and temperature appears. Aluminium hydride has been intensely studied as one of the most promising materials for hydrogen storage.

The large hydrogen content of AlH_3 leads to other interesting properties. It is well known that dense monoatomic hydrogen would be probably a room temperature superconductor. Some recent calculations put onset of metallization in solid hydrogen with the superconducting critical temperature T_c = 225 K at pressures 450 GPa [1]. These high pressures are far away from the current experimental limit for static pressures and low temperatures and also far away from the current experimental limit for shock pressures. There is another possibility to create a dense net of light elements which would have metallic conductivity. It was noticed [2] that "light" hydrides (such as CH_4, SiH_4, AlH_3, or MgH_2) might indeed be high-Tc superconductors. Theoretical [3] and experimental [4] studies of alane AlH_3 have investigated possible metallization at high pressures along the room temperature isotherm. The results obtained are sufficiently encouraging to prompt studies of a wider range of temperatures.

In this paper, the electrical conductivity of AlH_3 has been studied under multi shock compression up to 100 GPa. The conductivity of shocked alane increases in the range up to 60-75 GPa and is about 30 $(\Omega cm)^{-1}$. In this region the semiconductor regime is true for shocked alane as well as for multi shocked hydrogen [5]. The conductivity of alane achieves approximately 500 $(\Omega cm)^{-1}$ at 80-90 GPa. The conductivity is interpreted in frames of the conception of the ”dielectric catastrophe” [6], taking into consideration significant difference between electronic states of isolated molecule AlH_3 and condensed alane.

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