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Pressure-Induced Structural Phase Transition and Electrical

Properties of Cu₂S

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Abstract

The structural phase transition and electrical properties of Cu₂S have been investigated by X-ray diffraction and electrical resistance measurements at pressures up to 41.3 GPa in diamond anvil cell. A new high pressure phase is found above 22.3 GPa, which probably has a tetragonal structure. It is observed that the electrical resistance exhibits an insulating behavior at high pressures and low temperature. After the pressure is released, the high pressure phase transforms back to original monoclinic phase. This study sheds light on the electrical transport properties of Cu₂S, as well as to improve our understanding of its high pressure phase transition behavior.

Keywords: copper sulfides, structural phase transition, *in situ* electrical measurement, diamond anvil cell, high-pressure

I. Introduction

Over the past few decades, copper sulfides have attracted much attention due to the rich phases, complex structures and excellently tunable properties[1-10]. Cu_{2-x}S (0 ≤ x ≤ 1) has been known for an important P-type semiconductor[4], and it has been extensively investigated for its structural complexity and potential applications in battery solar cells[5], electrodes[6], switching[7], photocatalysis[10], sensing

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