An Analysis of the Superconducting Transition of Copper (II) Sulfide

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Superconductivity is a phenomenon in which the resistance of a material is zero when cooled below a critical temperature TC. High-temperature superconductors hold immense applications including perfectly efficient electricity transmission, ultra-high-speed supercomputing, powerful electromagnets used in maglev trains, and more cost-effective Magnetic Resonance Imaging (MRI). In 1970, Nakajima, Isino, and Kanda observed copper (II) sulfide (CuS) to exhibit superconductivity at approximately 1.6 K. However, the superconducting transition and behavior of CuS has not yet been analyzed. Due to its unique hexagonal lattice, CuS has potential to be a high-temperature superconductor through layer separation or lattice structure doping. This research produced a successful growth of copper sulfide crystals and performed an in depth analysis on the superconducting transition of the covellite. The CuS was studied regarding the resistivity and specific heat in various temperatures and magnetic fields to determine the variation between temperature and magnetic field at which the CuS exhibits a superconducting state and found the critical temperature TC to be 1.6 K. A further analysis of the resistivity and specific heat transitional behavior indicated that CuS is a d-wave, type-II superconductor.

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