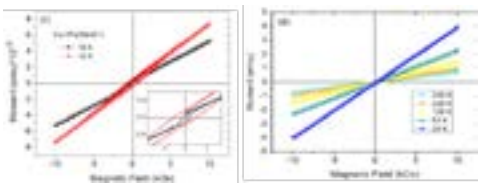
Process, characterization and ESR properties of 3d transition ion doped-tetrahedrite compounds

Cihat Boyraz[1], **Adil Guler**[1], **Cengiz Okay**[1], **Dmitri A. Shulgin**[2], **Georgy Mozzhukhin**[3] and **Bulat Rameev** [3, 4]
[1]Marmara University, Turkey
[2]Kazan National Research Technique University, Russian Federation
[3]Gebze Technical University, Turkey
[4] Kazan E K Zavoisky Physical-Technical Institute of RAS, Russian Federation

The increase in the usage of energy in the world brings an important global demand on finding new energy sources as either alternative or converting the waste energy for reuse. Among the types of waste energies, the heat energy plays an important role because of continuous wasting in our daily life from industry to our body heat. Due to the amount of waste heat is so high in daily life, the role of thermoelectricity topic in physics, which needs to be improved urges researcher to find alternative materials and to understand more on it. Among the many sulphate salts, the group of tetrahedrite/ tennatite has potential interest in physics in many ways are widely used in thermoelectric and photovoltaic applications. The importance of the thermoelectric researches is coming from neglecting the high material costs and long-termed synthesizing procedures. On the other hand, the properties of cheapness, accesibility, minimized risk factor in the usiage of thermoelectric materials make important for technological applications in scientific studies. Recently, tetrahedrite $Cu_{12}Sb_4S_{13}$ material doped with different dopant elements exhibits important thermoelectric properties. Tetrahedrite, $Cu_{12}Sb_4S_{13}$, is emerging as a promising phase in thermoelectrics. It exhibits an intrinsically low lattice thermal conductivity (κL = 0.4W m−1 K−1 at 700 K) due to unique features in its crystal structure. At the same time, the defect zinc-blende lattice ensures a good "crystalline" pathway for electron transport. At the same time, tetrahedrites are one of the most abundant TE minerals on Earth. In this study, main material $Cu_{12}Sb_4S_{13}$ tetrahedrite doped with 3d ions such as Sb and As were synthesized using solid state reaction method. The annealing procedure was optimized for Sb and As doped -$Cu_{12}Sb_4S_{13}$ tetrahedrite samples. Structural characterization was done by X-ray diffraction method (XRD). Scanning electron microscope (SEM) and an in-situ electron dispersive spectroscopy (EDS) were used for particle size and elemental compositions respectively. Electron spin resonance (EPR) and vibrating sample magnetometer (VSM) tools as shown in images also analyzed the compositions.

Marmara University Bapko BAPKO under Project Fen-D-070617-0383 supported this work.



Biography

Cihat Boyraz, Lecturer (Ph.D. physics), now is a Researcher in Marmara University, Faculty of Technology, Department of Mechanical Engineering. He got his B. Sc. in physics and Specialist in Magnetic and Superconductive materials. He got his Ph. D. at Marmara University department of physics. He worked in the research group of Prof. Dr. Arunava Gupta as a research scientist in Alabama State University. He also makes projects with Prof. Dr. Yildirhan Oner on superconductivity and magnetism. Dr. Boyraz's magnetic superconductivity group has been working on Fe-based superconductors for 5 years.

cboyraz@marmara.edu.tr

Notes: