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Process, characterization and physical properties of 3D transition ion doped-tetrahedrite compounds

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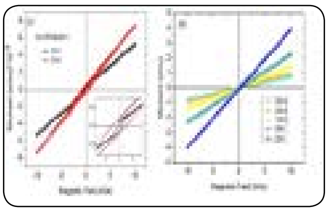
The demand on new and waste energy potential increases with decreasing energy sources in the world. This situation brings new attitudes globally on using waste energy and discovering new energy sources. Among the main types of waste renewable energy, thermoelectricity which is converted electric energy from waste heat play a very important role on science and with its applications on industry. Among the many sulphate salts, the group of tetrahedrite/tennantite 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 usage 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 ($\kappa L = 0.4 Wm^{-1}K^{-1}$ 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. The compositions were also analyzed by electron spin resonance (EPR) and vibrating sample magnetometer (VSM) tools as shown in images.



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Biography

Adil Guler, Lecturer, now is a Researcher in Marmara University, Ataturk Faculty of Education, Department of Computer and Instructive Technology Teacher. He completed his BSc degree in Physics and Specialist in Magnetic and Superconductive materials. He got his PhD at Marmara University, Department of Physics. He works in the research group of Prof. Dr. Arunava Gupta as a Research Scientist in Alabama State University. He also makes projects with Assist. Prof. Dr. Cihat Boyraz on superconductivity and magnetism. His magnetic superconductivity group has been working on Fe-based superconductors for 5 years.

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