SYNTHESIS AND CHARACTERIZATION OF TETRAHEDRITE $Cu_{10}Cd_2Sb_4S_{13}$ MONOGRAIN MATERIAL FOR PHOTOVOLTAIC APPLICATION

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$Cu_{10}(Zn,Cd)_2Sb_4(S,Se)_{13}$ compounds of the tetrahedrite structure (tetrahedrites) are receiving rising interest as new *p*-type semiconductor candidates for absorber materials in solar cell devices [1]. In this work the tetrahedrites were synthesized as monograin powders (MGP) in molten salt environment (CdI_2 as flux). Influence of different technological parameters (temperature, initial composition and the amount of CdI_2 flux material) on the elemental and phase composition, powder particle size distribution and shape of crystals was studied. MGPs were synthesized from Cu_2S, CdS, Sb_2S_3 (initial ratio of Cu : Cd : Sb : S = 10 : 2 : 4 : 13) in molten CdI_2 in closed vacuum ampoules heated at different temperatures (400, 440, 480, 495, 510 and 550 ^oC) for two weeks. The weight ratio of CdI_2 to target compound was 1 : 1. Mainly single phase tetrahedrite with composition close to the stoichiometrical $Cu_{10}Cd_2Sb_4S_{13}$ was formed at 480 and 495 ^oC (based on EDX and XRD data). Raman spectra of MGPs revealed three main peaks at 94, 111 and 362 cm^{-1}. The peak at 362 cm^{-1} is characteristic to the Cd containing tetrahedrite [2]. MGP grown at 495 ^oC was used as absorber material in monograin layer solar cell with a structure of ZnO/CdS/$Cu_{10}Cd_2Sb_4S_{13}$/graphite. The efficiency of the first tetrahedrite monograin layer solar cell was 0.11 %.

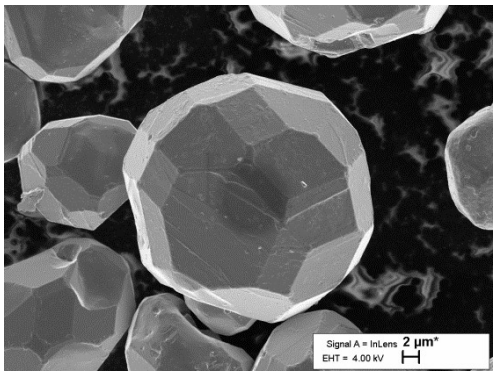

Fig1. SEM image of $Cu_{10}Cd_2Sb_4S_{13}$ monograin powder crystals synthesized at 480°C.

References

1. D.S.P. Kumar, M. Ren, T. Osipowicz, R.C. Mallik, P. Malar, 2018, *Solar Energy*, 174, 422430.
2. S. Bera, A. Dutta, S. Mutyala, D. Ghosh, N. Pradhan, 2018, *Journal of Physical Chemistry Letters*, 9, 1907-1912.

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