

Electroplating technology for the fabrication of $\text{Cu}_2\text{ZnSnS}_2$ nanowire arrays using anodic aluminum oxide template

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Chalcopyrite-type of one-dimensional as absorbing layer of solar cells has attracted a lot of attentions due to its property of high absorbance for visible light. Such as CIGS ($\text{Cu}(\text{In},\text{Ga})\text{S}_2$ or $\text{Cu}(\text{In},\text{Ga})\text{Se}_2$) nanowire solar cells are obtained remarkable high conversion efficiencies up to nearly 20% [1]. $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) is a promising material to realize more environmental friendly and low-cost compound photovoltaic cells because it does not require any toxic and rare element. Moreover, CZTS has a nearly optimal direct band gap energy of 1.4~1.6 eV for photovoltaic cells. In this study, we tried to prepare the CZTS nanowire arrays on substrates using self-organizing nanopore arrays as template for electroplating of CZTS.

Anodic aluminum oxide (AAO) pores was used as a template for the electroplating. Fig. 1 shows the schematics of the sample preparation: First, ITO and Al films were deposited by sputtering, and the Al films were anodized. After anodization, AAO pore slightly etched to remove the alumina layer at the pore bottom. Subsequently, Cu, Zn, Sn and S were electroplated in the AAO nanopores. We used the electroplating conditions, which had been optimized for preparation of CZTS films in our previous study.

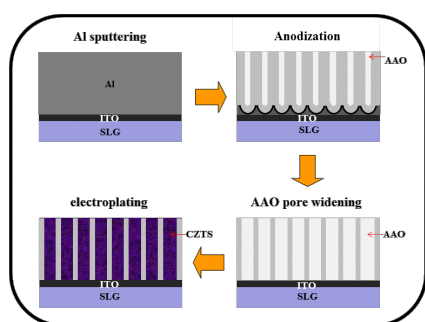


Fig.1 Schematics of the preparation of CZTS nanowire arrays

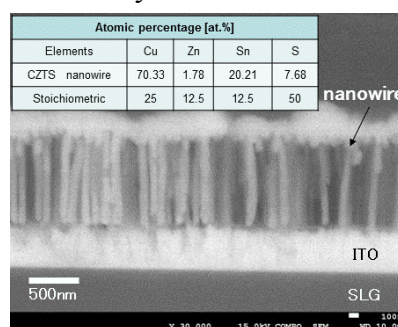


Fig. 2 Cross-view SEM image of the nanowires in AAO. Inset table indicates composition of the nanowires .

Fig.2 shows the SEM image of samples after electroplating. The vertically grown nanowire arrays with diameter of 100nm and length of 1um was successfully prepared in AAO template although the composition was not perfect stoichiometry of CZTS. Further, we are going to optimize the electroplating conditions to realize stoichiometric CZTS nanowires, and the result of light absorbance measurements of the nanowire sample will be present.

[1] X. L. Gou, F. Y. Cheng, Y. H. Shi, L. Zhang, S. j. Peng, J. Chen and W. Shen, J. Am. Chem. Soc., **128**, 7222.a(2006).