

課題番号 : F-19-FA-0029
 利用形態 : 機器利用
 利用課題名(日本語) : ナノ機能材料の合成及びナノエネルギーデバイスへの応用
 Program Title (English) : Synthesis of nano-functional materials and application to nano-energy devices
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 キーワード/Keyword : 表面処理、分析

1. 概要(Summary)

The Ag-Bi-I system has recently attracted much attention as a potential material for use in Pb-free solar cells due to its low toxicity and good stability. In this study, we synthesized a series of $Cs_xAg_{1-x}BiI_4$ absorbers via a simple method for Cs incorporation. By investigating the effect of the Cs cooperation, we found that the film quality of $Cs_xAg_{1-x}BiI_4$ was improved when introducing a certain amount of Cs, which is dense and pinhole free. In addition, the valence band edge of 5% Cs cooperated film is slightly upshifted. The corresponding $Cs_xAg_{1-x}BiI_4$ rudorffite solar cell achieved an enhancement of 40% in PCE for both the mesoporous structure and planar structure solar cells. After the Cs cooperation, the devices also show a better long-term air stability than that of the pure $AgBiI_4$.

2. 実験(Experimental)

【利用した主な装置】

走査型電子顕微鏡

【実験方法】

Cs was incorporated into the $AgBiI_4$ films. In order to confirm the existence of Cs, the EDX element measurements using the SEM device were carried out. The Cs containing $AgBiI_4$ films were prepared by spin-coating method and then were measured on the SEM device.

3. 結果と考察(Results and Discussion)

To further confirm their composition, we carried out the energy dispersive X-ray spectroscopy (EDX) measurement for the samples, as shown in Fig 1. The amount of Cs is 0 which indicate that in the final film, the amount of Cs

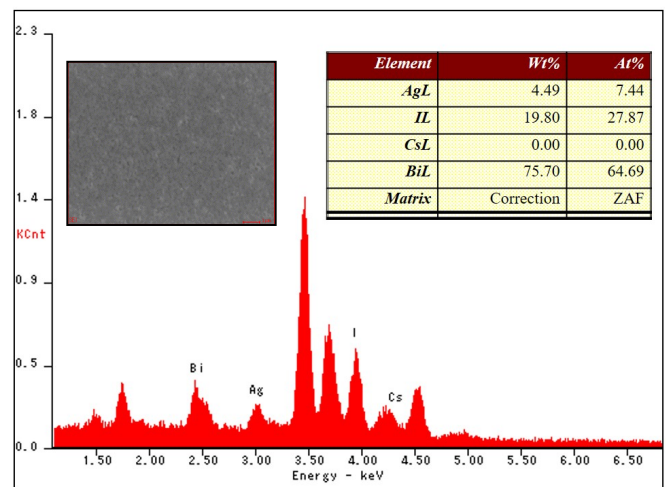


Fig 1. EDX spectrum of the Cs incorporated film.

is negligible, and we speculate that Cs is hard to replace Ag. Cs exist in crystal cell as an impurity atom.

4. その他・特記事項(Others)

参考文献:

Zhang Q, Wu C, Xiao L, et al. Photovoltage Approaching 0.9 V for Planar Heterojunction Silver Bismuth Iodide Solar Cells with Li-TFSI Additive. ACS Applied Energy Materials 2019, 2, 3651–3656.

5. 論文・学会発表(Publication/Presentation)

ポスト発表の予定: Cs-incorporated $AgBiI_4$ Rudorffite for Efficient and Stable Solar Cells, Fengyang Yu, Liang Wang, Shuzhang Yang, Tingli Ma, 日本化学会第100春季年会, 2020/3/22.

6. 関連特許(Patent)

なし