

課題番号 : F-18-FA-0010
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
利用者名(日本語) : 馬廷麗, 郭章林, 李寰, 張楚, テオショウワー, 楊樹章
Username(English) : Tingli Ma¹⁾, Zhanglin Guo¹⁾, Huan Li¹⁾, Chu Zhang¹⁾, Siowhwa Teo¹⁾,
Shuzhang Yang¹⁾,
所属名(日本語) : 1) 九州工業大学大学院生命体工学研究科
Affiliation(English) : 1) Kyushu Institute of Technology
キーワード/Keyword : 表面処理、分析、ナノエレクトロニクス

1. 概要(Summary)

MXenes, a newly intriguing family of 2D materials, have recently attracted considerable attention owing to their excellent properties such as high electrical conductivity and mobility, tunable structure, and termination groups. Here, the $\text{Ti}_3\text{C}_2\text{T}_x$ MXene is incorporated into the perovskite absorber layer for the first time, which aims for efficiency enhancement. Results show that the termination groups of $\text{Ti}_3\text{C}_2\text{T}_x$ can retard the crystallization rate, thereby increasing the crystal size of $\text{CH}_3\text{NH}_3\text{PbI}_3$. It is found that the high electrical conductivity and mobility of MXene can accelerate the charge transfer. After optimizing the key parameters, 12% enhancement in device performance is achieved by 0.03 wt% amount of MXene additive. This work unlocks opportunities for the use of MXene as potential materials in perovskite solar cell applications.

2. 実験(Experimental)

【利用した主な装置】

走査型電子顕微鏡

【実験方法】

The $\text{Ti}_3\text{C}_2\text{T}_x$ was added into the perovskite films. In order to confirm the existence of $\text{Ti}_3\text{C}_2\text{T}_x$, the EDX element mapping measurements using the SEM device were carried out. The $\text{Ti}_3\text{C}_2\text{T}_x$ containing $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite films were prepared by spin-coating method and then were measured on the SEM device.

3. 結果と考察(Results and Discussion)

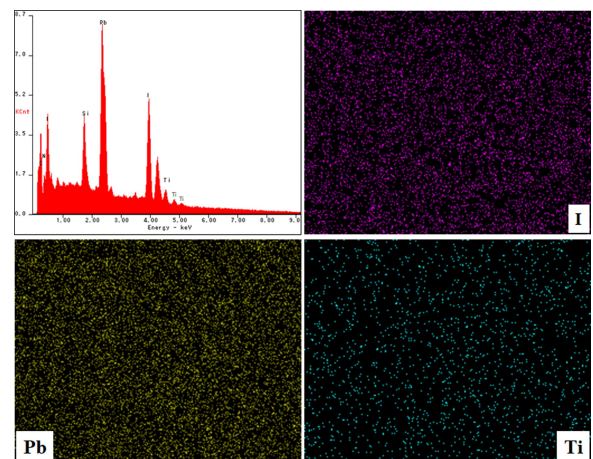


Figure.1 S8 EDX spectrum of the perovskite film with 0.25 wt% $\text{Ti}_3\text{C}_2\text{T}_x$ -DMF additive and element mapping of I, Pb and Ti.

To further confirm their composition, we carried out the energy dispersive X-ray spectroscopy (EDX) measurement for the samples, as shown in Figure S8. Several peaks attributed to titanium element are observed through EDX spectrum, which indicates the existence of the titanium element. Through the element mapping analysis, it shows that the titanium element is homogeneously distributed. The slightly low signal of titanium element is due to the usage of very low concentration. Therefore, when a small amount of $\text{Ti}_3\text{C}_2\text{T}_x$ additive was introduced into the perovskite film, the sheet particles only existed in the grain boundary.

4. その他・特記事項(Others)

競争的資金名:

公益財団法人 高橋産業経済研究財団

5. 論文・学会発表(Publication/Presentation)

- (1) High Electrical Conductivity 2D MXene Serves as Additive of Perovskite for Efficient Solar Cells, Guo Z., Gao L., Xu Z., Teo S., Zhang C., Kamata Y., Hayase S., Ma T., Small, 14, 47, 2018.

6. 関連特許(Patent)

なし