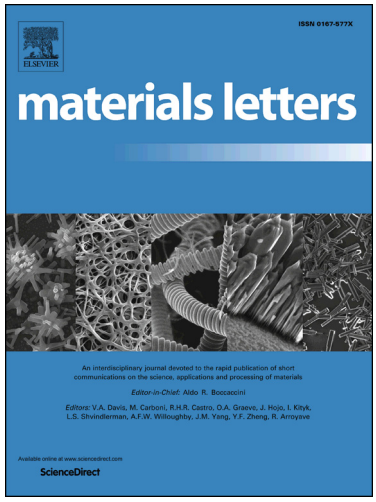

A facile method for the synthesis of large scale high quality $MAPbI_3$ perovskite for diverse applications

Govindhasamy Murugadoss, Rangasamy Thangamuthu, Manavalan Rajesh Kumar

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A facile method for the synthesis of large scale high quality $MAPbI_3$ perovskite for diverse applications

Govindhasamy Murugadoss [a,*], Rangasamy Thangamuthu[a], Manavalan Rajesh Kumar[b]

[a]*Materials Electrochemistry Division, CSIR-Central Electrochemical Research Institute, Karaikudi 630 003, Tamilnadu, India*

[b]*Institute of Natural Science and Mathematics, Ural Federal University, 620002 Yekaterinburg, Russia*

Abstract

High quality methylammonium lead iodide ($MAPbI_3$) perovskite powder was prepared by anti-solvent assisted method in large scale. Structure, optical and morphology were tuned with respect to the temperature. Four different structures such as intermediate, mixed or polycrystalline, tetragonal and cubic were prepared. The absorption edge of the tetragonal $MAPbI_3$ was located at about 850 nm, indicating that the band gap of $MAPbI_3$ is approximately 1.48 eV, which is close to the theoretical results and smaller than those derived from polycrystalline and thin-films. $MAPbI_3$ powder exhibits relatively wide absorption (from 250 nm to 850 nm) and good thermal stability.

Keywords: $MAPbI_3$; Structural; Optical materials and properties; perovskite powder; diverse application

*Corresponding Author Email: murugadoss_g@yahoo.com

1. Introduction

A major current focus in photovoltaic research is the use of methylammonium (MA) lead halide as the light-harvesting active layer in thin-film solar cells because it is cheaper to produce, simple to manufacture, and highly efficient. These merits make them one of the most promising candidates for the industrial development of next-generation optoelectronic devices [1-3]. The solar-to-electrical energy conversion efficiency of the perovskite solar cells has increased from 3.8% by Miyasaka and co-workers [1] to 22.1% by Kim and co-workers under 1 sun illumination by the efforts of numerous researchers [3]. The rapid increase in the performance is due to its outstanding properties such as high carrier mobility, long carrier diffusion, and large absorption coefficient. Interestingly, optical and electrical studies conducted on single crystals of organo-lead halide perovskites [4] revealed that the properties are considerably enhanced in single crystals compared to their polycrystalline thin film counterparts. However, choice of the single crystal for energy application is limited. Powder form of the perovskite can be used extensively in various energy applications including optoelectronics. For perovskite power preparation, temperature played a major role to achieve good crystalline with similar optical properties of the single crystal.