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Preparation and characterization of low temperature nanostructured perovskite solar cells

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Statement of the Problem: Reliable energy is essential in providing the much needed sustainable economical development for a modern society. Inevitably, due to the limitation in natural energy resources and the growing concern for environmental protection, alternative power generation technologies have become very important. The recent discovery of organic-inorganic perovskites offers promising routes for the development of low-cost, solar-based clean energy solutions for the future. Thin-film solar cells provide promising technology for cost-competitive solar power via reduced material and fabrication costs as compared to the prevailing crystalline silicon photovoltaic system. Such systems make use of high absorption of photons.

Methodology & Theoretical Orientation: Organic–inorganic hybrid solar cells that combine a mesoporous scaffold, a perovskite light absorber and an organic hole transporter have emerged at the forefront of solution-processable photovoltaic devices. However, they require high processing temperature of up to 500°C to sinter the mesoporous metal-oxide support. Here, we used different powder and solution spin coatings on the glass substrates to observe the different film-forming characteristics.

Findings: We demonstrated two low-temperature processes that could be stable with more than 10% conversion efficiency. In addition, we used dimethylsulfoxide (DMSO) instead of the common N, N-dimethylmethanamide (DMF) to dissolve PbI2 and to fabricate PbI2 films. This strategy overcame the problem of incomplete conversion and uncontrolled particle size of perovskite in the absence of mesoporous scaffolds, which greatly increased the film reproducibility.

Conclusion & Significance: After the parameters have been optimized, long time stability characterization could be carried out for the new high efficient solar cell system.

Biography

G.M. Wu has completed his PhD from the University of Delaware, USA and had been a visiting professor at the University of California at Los Angeles, USA. He is in charge of the Electro-Optical Engineering Laboratory of Chang Gung University in Taiwan. He has published more than 50 papers in reputed journals and served as technical consultants for a broad range of industrial companies. This study was supported in part by the Ministry of Science and Technology under research grants MOST105-2221-E182-059-MY3 and NERPD2E0481.

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