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Cu_2ZnSnS_4 Thin Film Absorber Synthesized by Chemical Bath Deposition for Solar Cell Applications

Vinaya Kumar Arepalli, Challa Kiran kumar, Namkyu Park, Lam Van Nang, Eui-Tae Kim†

Department of Materials Science and Engineering, Chungnam National University, Daejeon, Korea
(etkim@cnu.ac.kr†)

New photovoltaic (PV) materials and manufacturing approaches are needed for meeting the demand for lower-cost solar cells. The prototypal thin-film photovoltaic absorbers (CdTe and $Cu(In,Ga)Se_2$) can achieve solar conversion efficiencies of up to 20% and are now commercially available, but the presence of toxic (Cd,Se) and expensive elemental components (In, Te) is a real issue as the demand for photovoltaics rapidly increases. To overcome these limitations, there has been substantial interest in developing viable alternative materials, such as Cu_2ZnSnS_4 (CZTS) is an emerging solar absorber that is structurally similar to CIGS, but contains only earth abundant, non-toxic elements and has a near optimal direct band gap energy of 1.4～1.6 ev and a large absorption coefficient of $\sim 10^4$ cm^{-1}. The CZTS absorber layers are grown and investigated by various fabrication methods, such as thermal evaporation, e-beam evaporation with a post sulfurization, sputtering, non-vacuum sol-gel, pulsed laser, spray-pyrolysis method and electrodeposition technique. In the present work, we report an alternative method for large area deposition of CZTS thin films that is potentially high throughput and inexpensive when used to produce monolithically integrated solar panel modules. Specifically, we have developed an aqueous chemical approach based on chemical bath deposition (CBD) with a subsequent sulfurization heat treatment. Samples produced by our method were analyzed by scanning electron microscopy, X-ray diffraction, transmission electron microscopy, absorbance and photoluminescence. The results show that this inexpensive and relatively benign process produces thin films of CZTS exhibiting uniform composition, kesterite crystal structure, and good optical properties. A preliminary solar cell device was fabricated to demonstrate rectifying and photovoltaic behavior.

Keywords: Solar cell, CBD, CZTS

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Porous Hyaluronic Acid-Gelatin Loaded Sponge Biphasic Calcium Phosphate Scaffold for Bone Implant Application

Nguyen Thuy Ba Linh, Shin Woo Kim[1], Young Ki Min[1], Hun Mo Yang[1], Byong-Taek Lee†

Department of Biomedical Eng. & Mater., College of Medicine, Soonchunhyang University,
[1]Department of Physiology, College of Medicine, Soonchunhyang University
(lbt@sch.ac.kr†)

In this study, hyaluronic acid (HyA) - Gelatin (Gel) hydrogels were prepared at ratio of 15:85 with the goal of obtaining a high uniform porosity and porous biocompatibility scaffold for bone tissue engineering applications. In order to develop a proper scaffold for bone implant application, a HyA-Gel hydrogel loaded in sponge Biphasic Calcium Phosphate (BCP) was prepared. To assay the cytocompatibility and cell behavior on the HyA-Gel hydrogel and HyA-Gel/BCP scaffold, cell attachment and spreading of MSCs seeded on the scaffolds were studied. An invivo study was performed for HyA-Gel/BCP scaffolds after 1 and 3 months implantation. Our results provide a novel and simple method to obtain an adequate scaffold for osteoblast cells and indicate that HyA-Gel hydrogel and HyA-Gel/BCP scaffold could be a good candidate for bone tissue engineering scaffolds.

Keywords: Hyaluronic acid, Gelatin, Biphasic Calcium Phosphate, MSCs, Bone implant