International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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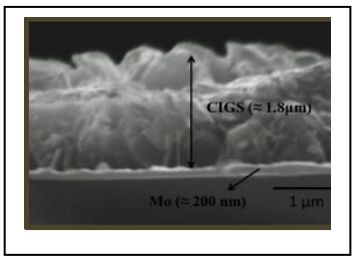
CIGS Based Thin-Film Solar Cells by Electrodeposition Technique

Overview

CIGS ($CuIn_{1-x}Ga_xSe_2$)based solar cells possess several commercial advantages over the conventional Si-based solar cells including, low production cost, minimum material requirement, better performance in low-light or diffused light conditions and possibility of making on flexible substrates. It is one of the most promising semiconductor materials for absorber layer in thin film solar cells with highest efficiency, due to its suitable band-gap and large optical absorption coefficient (≈ 10^5 cm^{-1}). CIGS thin films have extensively been studied using several methods, however an economical and simple method like electrodeposition which can be scaled up to industrial level fabrication is preferable. Pulse electrodeposition is a versatile electrodeposition technique over conventional electrodeposition and is expected to improve the quality of the deposited CIGS film in terms of composition and morphology.

Key Features

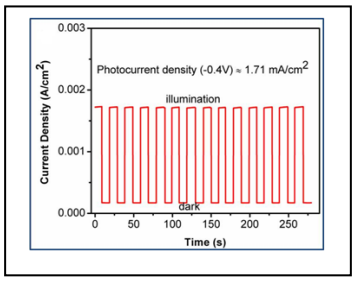
- Non-vacuum based room temperature technique
- Maximized material utilization
- Environmental friendly and economical
- Can be made on flexible substrates
- A scalable process with good reproducibility



FESEM image of the cross section of the electrodeposited CIGS thin-film

Potential Applications

- BIPV applications
- Flexible panels for solar cells
- Space applications and at remote locations



PEC performance of the electrodeposited CIGS absorber layer

Intellectual Property Development Indices (IPDI)

- CIGS/CdS junction performance is studied and validated by PEC.
- Device fabrication and performance are being done

Status	1	2	3	4	5	6	7	8	9	10

Major Patents/Publications

1. **Sarada B. V.,** Sreekanth Mandati, Shrikant V. Joshi,A Novel Electrochemical Method for Manufacturing CIGS Thin-Films Containing Nanomesh-like Structures (Indian Patent Filed)
2. Sreekanth Mandati, **Sarada B. V.**, Suhash R. Dey, Shrikant V. Joshi, $CuIn_{1-x}Ga_xSe_2$ thin-film absorber layers for solar photovoltaics fabricated by two-stage pulsed current electrodeposition, *Materials Letters* **118**, 158 (2014).
3. Sreekanth Mandati, **Sarada B. V.**, Suhash R. Dey, Shrikant V. Joshi Photoelectrochemistry of sequential pulse electrodeposited Cu(In,Ga)Se_2 Thin-films, *Journal of Power Sources,* **273** (2015) 149

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