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Copper-indium-galium-selenide thin films for solar cell applications

Center Overview: The Center for Autonomous Solar Power, started in early 2010, is a part of the State University of New York at Binghamton. The major emphasis of the center is to develop futuristic thin film solar cell technologies using earth-abundant materials on flexible substrates.

Abstract: Thin film solar cells are being researched extensively in the last few decades because of the advantages such as requirement of small amount of material as compared to silicon solar cells, material purity required is lower as compared to silicon solar cells; they have favorable direct band gap and can be prepared over large areas, using low cost substrates, thus leading to lower processing and handling costs. Copper-indium-galium-selenide/sulfide is a well-established thin film solar cell technology with laboratory level efficiencies around 20% and is already commercialized as well. Copper-indium-galium-sulfide (CIGS₂) is a wide-band gap material from the same chalcopyrite family and has exhibited the laboratory level efficiency of 13%. CIGS₂ thin film solar cells have been grown with copper-rich compositions because of the phase stability issues; however it has been found that these cells can also be grown with copper-deficient compositions under certain conditions and reasonable photovoltaic performance can be demonstrated using these conditions. If grown with copper-deficient compositions, the processing window of the CIGS₂ solar cells can be increased considerably.

Biographical sketch: Dr. Vasekar received his B.E. and M.E. degrees in Metallurgy from Government College of Engineering, Pune, India in 1998 and 2001 respectively, followed by M.S. degree in materials science and engineering from Vanderbilt University, Nashville, TN in 2004 and Ph.D. degree from the University of Central Florida, Orlando, FL in 2009. He joined the Ohio State University in 2009 as a post-doctoral fellow. In 2010, he joined the Center for Autonomous Solar Power at the Binghamton University in Binghamton, NY as a post-doctoral fellow and became a research scientist in Feb. 2011. His research interests include thin film solar cells – synthesis and characterization. Dr. Vasekar is an active member of the Materials Research Society (MRS), American Society of Materials (ASM), The Minerals, Materials and Metals Society (TMS) and American Vacuum Society (AVS). In 2010, he was nominated as a full member of Sigma XI. He has more than twenty peer-reviewed publications.