

### III. CENTER PUBLICATIONS

#### (1) Published Refereed Journal Articles

- 8) P. R. Kharangarh<sup>1</sup>, D. Misra<sup>2</sup>, G. E. Georgiou<sup>1</sup>, and K. K. Chin<sup>1</sup>, "Characterization of space charge layer deep defects in n<sup>+</sup>-CdS/p-CdTe solar cells by temperature dependent capacitance spectroscopy," *J. Appl. Phys.* 113, 144504 (6 pages) (2013); <http://dx.doi.org/10.1063/1.4800830>
- 7) Zhitao Wang, Zimeng Cheng, Alan E. Delahoy and Ken K. Chin, "A Study of Light-Sensitive Ideality Factor and Voltage-Dependent Carrier Collection of CdTe Solar Cells in Forward Bias", *IEEE Journal of Photovoltaics*, 3, 843-856 (2013).
- 6) P. Kharangarh, D. Misra, G. E. Georgiou, and K. K. Chin, "Evaluation of Cu Back Contact Related Deep Defects in CdTe Solar Cells", *ECS Journal of Solid State Science and Technology*, 1 (5), pp. Q110-Q113, September 2012.
- 5) Ken K. Chin, "Dual Roles of Doping and Trapping of Semiconductor Defect Levels and Their Ramification to Thin Film Photovoltaics," *J. Appl. Phys.*, Vol. 111, 000000- 01 - 09 (2012).
- 4) Ken K. Chin, "Local Charge Neutrality Condition, Fermi Level, and Majority Carrier Density of Semiconductor with Multiple Localized Multi-Level Intrinsic/Impurity Defects," *Journal of Semiconductors*, 32 (11), p. 112001-1-8 (2011).
- 3) Ji Ma, Su-Huai Wei, and T. A. Gessert, NREL, Golden, CO, USA, and Ken K. Chin, Apollo CdTe Solar Energy Research Center, NJIT, Newark, NJ, USA, "Carrier density and compensation in semiconductors with multi dopants and multi transition energy levels: The case of Cu impurity in CdTe," *Phys. Rev. B* 83, 245207 (2011).
- 2) Ken K. Chin, "Approximate Graphical Method for Solving Fermi Level and Majority Carrier Density of Semiconductors with Multiple Donors and Multiple Acceptors," *J. Semiconductors*, 32 (6), p. 062001-1-6 (2011).
- 1) Ken K. Chin, "p-Doping Limit and Donor Compensation in CdTe Polycrystalline Thin Film Solar Cells", *Science Direct, Solar Energy Materials and Solar Cells* 94, 1627-1629, Elsevier, May 31 (2010).

(2) IEEE PVSC (Photovoltaic Specialists Conference)

39<sup>th</sup> PVSC, Tampa, FL, June 2013

9) A.E. Delahoy, Z Cheng, K.K. Chin “Evidence for CdTe<sub>1-x</sub>S<sub>x</sub> Compound Formation in CdTe Solar Cells from High-Precision, Temperature-Dependent Device Measurements” 39th IEEE Photovoltaic Specialists Conference, June 16-21, 2013, Tampa FL.

38th PVSC, Austin TX, June 2011

8) Z. Cheng and K.K. Chin, “The Steady State Occupancy and Effective Fermi Level of p-n Junction”, Proc. of 38th PVSC, Jun 2012, Austin, TX USA, p. 25.

7) P. Kharangarh, D. Misra, G. E. Georgiou, A. Delahoy, Z. Cheng, G. Liu, H. Opyrchal and K. K. Chin, “Investigation of defects in n+CdS/p-CdTe Solar Cells”, presented to 38th IEEE Photovoltaic Conference Proceeding, pp. 1286-1290, Austin, TX, June 2012.

37th PVSC, Seattle WA, June 2011

6) Guogen Liu, Zimeng Cheng, Barat, R.B., Jingong Pan, Georgiou, G.E.; Chin, K.K., “Large area Cds thin film grown by chemical bath deposition”, Proc. of 37th PVSC, Jun 2011, Seattle, Washington USA, p. 3750.

5) Su-Huai Wei; Jie Ma; Gessert, T.A.; Chin, K.K., “Carrier density and compensation in semiconductors with multi dopants and multi transition energy levels: The case of Cu impurity in CdTe”, Proc. of 37th PVSC, Jun 2011, Seattle, Washington USA, p. 2833.

35th PVSC, Honolulu, June 2010

4) Zimeng Cheng<sup>1</sup>, Kwok Lo<sup>2</sup>, Dongguo Chen<sup>1</sup>, Jingong Pan<sup>1</sup>, Tao Zhou<sup>2</sup>, Qi Wang<sup>3</sup>, George E. Georgiou<sup>1</sup>, and Ken K. Chin<sup>1</sup>, “Working Quantum Efficiency of CdTe Solar Cell,” (<sup>1</sup>Department of Physics, Apollo CdTe Solar Energy Center, NJIT, Newark NJ 07102 USA, <sup>2</sup>Department of Physics, NJIT, Newark NJ 07102 USA, <sup>3</sup>National Renewable Energy Laboratory (NREL), Golden, CO 80401, 978-1-4244-5892-9/10, p. 1912-1914, 35<sup>th</sup> IEEE PVSC, Honolulu, Hawaii, USA (2010).

3) “Local Charge Neutrality Condition, Fermi Level, and Majority Carrier Density of Semiconductors with Impurity/Defect States of Multiple Energy Levels and of Multiple Atomic Configurations,” by Ken K. Chin<sup>1</sup> and Suhuai Wei<sup>2</sup>, 35<sup>th</sup> IEEE PVSC Oral Presentation, Pages 878-884, Art no 5614140.

2) “The Roles of Cu Impurity States in CdTe Thin Film Solar Cells,” by Ken K. Chin<sup>1</sup>, Tim Gessert<sup>2</sup>, and Suhuai Wei<sup>2</sup>, <sup>1</sup> Department of Physics and Apollo CdTe Solar Energy Research Center, NJIT, Newark, NJ 07058, <sup>2</sup> National Renewable Energy Laboratory, Golden, CO 80401, 35<sup>th</sup> IEEE PVSC, Pages 1915-1918, Art no 5614140.

34th PVSC, Philadelphia, June 2009

1) "A Novel Concentrator Design with PV Junctions on the Sides of a Flat Panel", by Jiansheng Liu<sup>1</sup>, Jingong Pan<sup>2</sup>, George E. Georgiou<sup>2</sup>, Ken K. Chin<sup>2</sup>, Zheng Zheng<sup>1</sup>, Junge Tan<sup>1</sup>, EEE PVSC34, Philadelphia, USA, June 8-12, 2009, Pages 001127-001131, Art no 5411218.

3) EU PV SEC (European Photovoltaic Solar Energy Conference)

27th EU PV SEC, Frankfurt, Germany, Sept. 2012

5) A.E. Delahoy, Z. Cheng and K.K. Chin, "Carrier Collection in Thin-Film CdTe Solar Cells: Theory and Experiment" at 27th EUPVSEC, Sep 2012, Messer Frankfurt, Germany, p. 2837.

4) Z. Wang, Z. Cheng, A.E. Delahoy, K.K. Chin, "New Solar Cell Modeling for CdTe Solar Cell", 27th EUPVSEC, Sep 2012, Messer Frankfurt, Germany, p. 2843.

25th EU PV SEC, Valencia, Spain, Sept. 2010

3) Zimeng Cheng, Zhitao Wang, Poonam Kharangarh, Dongguo Chen, Guowei Wang, Zheng Zheng, Jiansheng Liu, George E. Georgiou, and Ken K. Chin, "Simulations of Dopants of p-CdTe thin film in n-CdS/p-CdTe Solar Cell" at

2) "Thermionic Emission Theory and Diffusion Theory of Type II p-n Hetero-junctions Used in CdTe PV Devices," by Rumin Zhang<sup>1</sup>, Jiansheng Liu<sup>1</sup>, Zheng Zheng<sup>1</sup>, Guowei Wang<sup>1</sup>, G. Georgiou<sup>2</sup>, Ken.K.Chin<sup>2</sup>, <sup>1</sup>School of Electronic and Information Engineering, Beihang University, Beijing 100191, China, <sup>2</sup>Department of Physics and Apollo CdTe Solar Energy Center, New Jersey Institute of Technology, NJ 07058, USA, Proceedings p. 3486, 25<sup>th</sup> EU Photovoltaic Solar Energy Conference and Exhibition / 5th World Conference on Photovoltaic Energy Conversion, 6-10 September 2010, Valencia, Spain.

1) "Numerical and Graphical Method for Calculation of Majority Carrier Compensation of Multiply Doped Semiconductors Used in Photovoltaics," by Guowei Wang<sup>1</sup>, Jiansheng Liu<sup>1</sup>, Zheng Zheng<sup>1</sup>, Zimeng Cheng<sup>2</sup>, Jingong Pan<sup>2</sup>, George Georgiou<sup>2</sup>, Ken K. Chin<sup>2</sup>, Proceedings p. 359, 25<sup>th</sup> EU Photovoltaic Solar Energy Conference and Exhibition / 5th World Conference on Photovoltaic Energy Conversion, 6-10 September 2010, Valencia, Spain.