EC806 ENERGY HARVESTING USING PEROVSKITE MATERIALS 3-0-0-3

Unit: 1

Perovskite materials: - Average Crystal Structure- Orthorhombic, Tetragonal & Cubic Phases - From Methylammonium to Formamidinium- Molecular Motion.

General Trend of Defect Levels in CH3NH3PbX3 Perovskites - Calculated Transition Energies of Intrinsic Point Defects- Calculated Formation Energy of Intrinsic Point Defects - Calculated Surface States- Calculated Grain Boundary States - Doping Properties of CH3NH3PbI3.

Unit: 2

Piezoelectric Materials: Piezoelectric Polycrystalline Ceramics, Piezoelectric Single Crystal Materials, Piezoelectric and Electrostrictive Polymers, Piezoelectric Thin Films.

Unit: 3

Quantum Efficiency of Electroluminescence- Identifying Recombination Mechanisms, Role of the Charge Transport Layers. Capacitive Anomalies in Perovskite Solar Cells – Hysteresis, Impedance Spectroscopy, Stoichiometry Polarization, Open-Circuit Voltage Measurements.
Ion Migrations in Solid State Materials - Ion Migration in Organolead Trihalide Perovskite Films - Impact of the Ion Migration on Photovoltaic Efficiency and Stability - Suppressing Ion Migration for Stable OTP Solar Cells

Unit: 4

APbI3 (A = CH3NH3 and HC(NH2)2) Perovskite Solar Cells: From Sensitization to Planar Hetero-junction:- Optical Properties and Band Structure of CH3NH3PbI3 - Sensitized Perovskite Dots in Liquid Electrolyte - The First Version of Solid-State CH3NH3PbI3 Perovskite Solar Cell - Controlled Method for Preparing Perovskite Films - Perovskite Solar Cells Based on Formamidinium Lead Iodide - Stability of HC(NH2)2PbI3 Perovskite.

Unit: 5

Inverted Planar Structure of Perovskite Solar Cells: - Planar Structure - Inverted Planar Structure - Film Growth for Improving Efficiency of Inverted Planar Solar Cells, Film Growth for Improving Efficiency of Inverted, Interface Engineering of Electron Transport Layer, Stability of Inverted Structure , Effect of Electron Transport Layer on Stability, Effect of Hole Transport Layer on Stability, Perovskite Materials Stability, Hysteresis in Inverted Planar Solar Cells.

TEXT BOOKS:

1. Park, Nam-Gyu, Tsutomu Miyasaka, and M. Grätzel. *Organic-inorganic halide perovskite photovoltaics*. Cham, Switzerland: Springer, 2016.

2. Wei-guang, Diau Eric, and Chen Peter Chao-yu, eds. *Perovskite Solar Cells: Principle, Materials and Devices*. Vol. 1. World Scientific, 2017.

3. Fu, Kunwu, Anita Ho-Baillie, Hemant Kumar Mulmudi, and Pham Thi Thu Trang. "Perovskite Solar Cells: Technology and Practices." (2019).

REFERENCES:

1. Ono, Luis K., Emilio J. Juarez-Perez, and Yabing Qi. "Progress on perovskite materials and solar cells with mixed cations and halide anions." *ACS applied materials & interfaces*9, no. 36 (2017): 30197-30246.Crystallography and Chemistry of Perovskites by Mats Johnsson a and Peter Lemmens b
2. Uchino, Kenji. "Glory of piezoelectric perovskites." *Science and technology of advanced materials* 16, no. 4 (2015): 046001.
3. Priya, Shashank, and Daniel J. Inman, eds. *Energy harvesting technologies*. Vol. 21. New York: Springer, 2009
4. Caliò, Renato, Udaya Bhaskar Rongala, Domenico Camboni, Mario Milazzo, Cesare Stefanini, Gianluca De Petris, and Calogero Maria Oddo. "Piezoelectric energy harvesting solutions." *Sensors* 14, no. 3 (2014): 4755-4790.