



**Seminar Topic:
Metal-Halide Perovskites: Exceptional Semiconducting Materials for High
Performance Solar Cells and Light-Emitting Devices**

Professor Subodh Mhaisalkar

Abstract

The past five years have witnessed remarkable advances in the field of solar cells and light-emitting devices (LEDs) with the perovskite metal halide, $\text{CH}_3\text{NH}_3\text{PbI}_3$, and related family of materials. These semiconductors form nearly defect free, crystalline films at low temperatures and exhibit high optical absorption, long-range charge transport, and efficient charge collection, yielding high performance solar cells and LEDs.

The prospects for advancing device efficiencies are contingent on exploring new perovskite compositions and structures. One such structural variant is represented by lower-dimensionality layered perovskite derived from their 3D counterparts (ABX_3) with the incorporation of organic cations. These formulations permit for tuning of band gaps and exciton binding energy, and additional controls for stability, light harvesting, and intra-layer charge transport.

Nanocrystals is yet another variant in perovskites which promise to yield new opportunities in advancing device performance. By carefully controlling the reaction conditions, such as temperature, solvent and ligands, hybrid perovskites of morphologies ranging from 0D quantum dots to 3D single crystals, with sizes stretching 6 orders of magnitude, can be prepared.

Challenges and opportunities in perovskite materials beyond methylammonium lead iodide, with emphasis on their recombination dynamics, optoelectronic properties, and integration into solar cells and LEDs, will be addressed.

Biography

Professor Subodh Mhaisalkar is the Tan Chin Tuan Centennial Professor in the School of Materials Science and Engineering at Nanyang Technological University, Singapore. He is also the Executive Director of the Energy Research Institute @ NTU (ERI@N), a pan-University multidisciplinary research institute for innovative energy solutions. Prior to joining NTU in 2001, Professor Mhaisalkar has over 10 years of research and engineering experience in the microelectronics industry. His areas of expertise and research interests include semiconductor technology, perovskite solar cells, printed electronics and energy storage. He received his Bachelor's degree from IIT-Bombay and his M.S. and Ph.D. degrees from The Ohio State University.

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Hosted by: Professor Wang Junling**