



SATAPATHI LAB



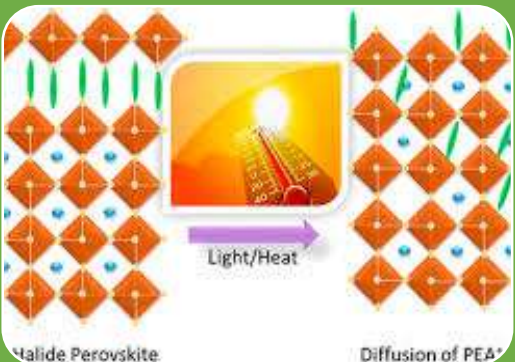
Tandem Solar Cell Technology

Our research group at IIT Roorkee focuses on developing high-efficiency perovskite-based tandem solar cells. We utilize the unique properties of metal halide perovskites—such as tunable bandgaps, low recombination losses, and low-cost processing—to integrate them with silicon and other absorbers. Through material design, interface engineering, and machine learning simulations, we work to reduce losses and push solar cell efficiencies beyond the limits of single-junction devices.



Large- Scale Fabrication and Industrial Collaboration

Our research is supported by advanced fabrication facilities with scalable techniques like evaporation, sputtering, slot-die coating, and screen-printing. This enables us to move from lab prototypes to industrial-scale perovskite tandem solar cells. We are also collaborating with GAIL (India) Limited on developing high-efficiency perovskite-silicon multi-junction devices.



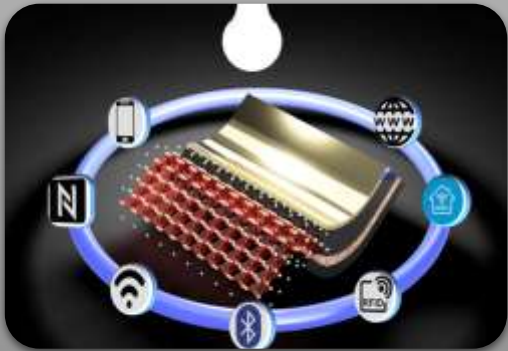
2-D Halide for Optoelectronic Application

In our lab, we are actively exploring two-dimensional (2D) halide materials for advanced optoelectronic applications. These layered materials exhibit tunable bandgaps, strong excitonic effects, and excellent light–matter interactions. Our focus is on harnessing their superior charge transport and stability to improve device performance. This research paves the way for developing efficient solar cells, LEDs, photodetectors, and other next-generation optoelectronic devices.



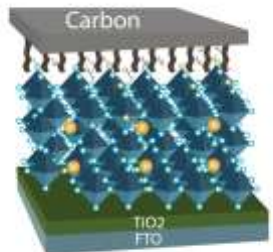
Semi-Transparent Perovskite Solar Cells

Our Lab is actively involved in research on Semi-transparent perovskite solar cells (ST-PSCs), a technology enabling applications like Building integrated Photovoltaics (BIPV). Our work focuses on improving ST-PSCs by engineering interfaces, controlling film crystallization, and enhancing light utilization efficiency to balance the power conversion and transparency.



Indoor Photovoltaics

Our group is working on the development of perovskite and perovskite-inspired materials, including ruddorfites and ternary chalcogenides, for indoor photovoltaics. These materials possess tunable bandgaps and exhibit remarkable photophysical properties, which we are concurrently investigating for potential applications in optoelectronics.



Carbon Based Electrodes Perovskite Solar Cells

Our lab also focuses on Carbon-based electrodes as a cost-effective and stable alternative to traditional noble metal electrodes. Research focuses on improving the carbon/perovskite interface, promote stability, and reduce fabrication costs for commercialization.