Metal Halide Perovskites:
Fundamentals, Properties, and Applications

Samrat Das Adhikari, PhD

(Team 26)

Registration: send an email to sdadhikari@ichf.edu.pl by October 20. The course starts within the week of October 27-31, 2025

(The availability of this lecture course depends on whether at least three Warsaw4PhD students are registered.)

Objectives

To provide the basic concept of structure and photophysical properties of metal halide perovskites, and their diverse optoelectronic device applications including solar cells, LEDs, photocatalytic performances, among others.

Course content:

Topic	Subtopic	Tentative duration	Grade weightage
Introduction to Perovskites	History & discovery of perovskite structure	Lecture 1	15%
	General ABX_3 framework and classification	Lecture 1-2	
	From oxide perovskites to halide perovskites	Lecture 2	
Crystal Structures & Chemistry	Tolerance factors & stability	Lecture 3	25%
	Organic–inorganic hybrid perovskites	Lecture 3	
	Dimensionality (3D, 2D, quasi-2D, 1D, 0D)	Lecture 4-5	
	Introduction to the Ruddlesden-Popper and Dion-Jacobson perovskites	Lecture 5-6	
Synthesis & characterizations	Colloidal synthesis of perovskite nanocrystals	Lecture 7	20%
	Solution-processed thin films	Lecture 7-8	
	Structural analysis	Lecture 8-9	
	Photophysical properties	Lecture 9	
Applications	Solar cells: fabrication and characterizations	Lecture 10-11	35%
	Light-emitting diodes: fabrication and characterizations	Lecture 12-13	
	Catalysis	Lecture 14	
Future Outlook & Research Directions	Roadmap to commercialization	Lecture 15	10%
	Progress of Pb-free perovskites	Lecture 15	