

# The Optical Band Gap of Perovskite Materials for Solar Cells

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Perovskite thin films  $CH_3NH_3PbCl_{3-x}Cl_x$  in this project are deposited by two-step deposition method to study the effect of chloride on the optical band gap. In this experiment, the band gap is insignificantly increased from  $1.60 \pm 0.01$  eV with no Cl-doping to  $1.62 \pm 0.01$  eV with 16% Cl-doping because some chloride ions cannot replace the iodide positions in  $CH_3NH_3PbI_3$  and form  $CH_3NH_3PbCl_3$  instead. Though the crystal structure of  $CH_3NH_3PbI_3$  is cubic, with heavily Cl-doping, the crystal structure of  $CH_3NH_3PbCl_{3-x}Cl_x$  becomes tetragonal and longer annealing time results in the leaving of Chloride in  $CH_3NH_3PbCl_{3-x}Cl_x$ . The presence of residual  $PbI_2$  also affects the photon absorption of perovskite.

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