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Unravelling Defects in Hybrid Perovskite Solar Cell Structures[1]
CHRISTIAN SAIZ, LUIS MARTINEZ, SRINIVASA RAO SINGAMANENI, University of Texas at El Paso — The hybrid organic-inorganic halogenoplumbate perovskites ($MeNH_3PbX_3$, where X is I and/or Br) have shown extraordinary photovoltaic properties with the record 22% power conversion efficiency. The defects are known to cause unwanted hysteretic effects and device degradation. However, the usage of suitable defect-sensitive experimental techniques is necessary for their atomic level identification. In this work, we extensively employed electron spin resonance (ESR) spectroscopy at cryogenic temperatures to atomically identify the defects. For our study, we chose the inverted solar cell structure: PCBM/$CH_3NH_3PbI_3$/PEDOT:PSS/Glass, where, the PCBM and PEDOT:PSS act as electron and hole transport layers. To accomplish this task, we prepared a series of samples as a function of ex-situ simulated solar irradiation up to 4 hours 30 minutes, including the sample which was not exposed to light. Controlled measurements were performed on moisturized, N_2 gas, and UV-ozone treated samples to trace out the origin of ESR signals.

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