

Effect of Defect Production on Photoluminescence & Positron Trapping in He ion Implanted Methylammonium Lead Tri-Iodide Perovskite Layers

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Hybrid inorganic-organic halide perovskites attract much attention for their application in optoelectronic devices. However, the performance in domain such as photovoltaics still strongly depends on the quality of the active layers and their capacity to stand device operation without irreversible damage. Applying a bias in dark in CH₃NH₃PbI₃ (MAPbI₃) based solar cells results in ion migration [1]. This questions the generation and role of defects under bias and light illumination [2,3] on photovoltaic performance.

In this work, Helium ion implantation is used as a tool for the introduction of point defects in a controlled way in polycrystalline MAPI layers spin coated on glass/ITO/PEDOTT:PSS. The created point defects may introduce energy levels and modify electronic and light emitting properties of the material. The defect production has a strong effect on photoluminescence (PL), time-resolved photoluminescence (TRPL) and PAS spectra. The results illustrate how the optical and positron behavior depend on the layer history before and after He ion implantation.

References

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