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Present status and future prospects of perovskite based Optoelectronic devices

Metal halide perovskites have fascinated the research community over the past few years, mainly in the photovoltaic (PV) field, largely due to a combination of their high quality optoelectronic properties, unexpected for materials processed from solution at low temperature and the ease with which they can be used as absorber layers in highly efficient photovoltaic devices. Since the earlier reports in 2012, metal halide perovskite material are on the way to deliver high PV performances and today single junction solar cells have overpassed power conversion efficiency (PCE) of 23%. However, beyond power efficiency, other critical factors are required to allow the transition from laboratory to industrial production. This include low manufacturing costs and long term stability which has raised major concern. Researchers have demonstrated that it is possible to easily obtain PCE beyond 20%, but reaching the maximum theoretical performance and demonstrating longterm stability requires further understanding of the optoelectronic properties of perovskite devices and how they can be practically controlled. A solution to obtain higher efficiencies is the multi-junction concept which combine perovskite layers with silicon substrate (or other materials) in order to expend the absorption spectral range and so the amount of light radiation converted into electricity. This approach is very promising as it is possible to tune the optical bandgap of the perovskite material from 1.2 eV up to 2 eV, depending on the chemical composition of the material. Aging causes electronic degradation in perovskite layer and-or at the different interfaces leading to hysteresis effect, but the defect chemistry and physics are still not really understood. In this presentation we try to overview the state of the art of the different perovskite solar cells structures as well as other optoelectronic devices and give some results and analysis of the stability related issues.

Biography

Alain Rolland has completed his PhD in 1993 from "Université de Rennes 1" (France) and is professor of Physics at the "Institut de Technologie de Lannion - Université de Rennes 1" (France). He has in charge the device simulation task at FOTON-OHM laboratory, CNRS UMR 6082. He has published more than 70 papers in reputed international journals.

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