STABILITY OF HYBRID AND ORGANIC SOLAR CELLS

Emilie Planès[1*], Manon Spalla[1, 2], Sacha Juillard[1,2], Lara Perrin[1], Muriel Matheron[2], Solenn Berson[2], Lionel Flandin[1]

[1] Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, LEPMI, 38000 Grenoble, France

[2] Univ. Grenoble Alpes, CEA, LITEN, INES, F-73375 Le Bourget du Lac, France

* emilie.planes@univ-smb.fr

In the field of photovoltaics, the main remaining challenge now concerns the stability. There is a vital need for a better understanding of the degradation mechanisms and thereby the possible mitigation strategies. The presented work focuses on the stability of organic and perovskite solar cells. Thanks to several studies carried out in the field, it is possible to distinguish different types of stabilities which ultimately have an impact on the overall stability of the device. For the first level which concerns the intrinsic stability of solar cell, a study on the impact of the perovskite ($MAPbI_3$) chlorine proportion and on the nature of ETL (aluminium doped zinc oxide (AZO) and tin oxide (SnO_2)) is proposed. A detailed study with complementary characterizations techniques (XRD, photoluminescence, UV-Visible absorption) helped understanding the degradation processes in the active layer. Infrared spectroscopy had for instance been sparsely employed to characterize perovskite. To mitigate the degradation by water and oxygen and increase the lifetime of these devices, these latter must be encapsulated. For the second level of stability, we propose a study of the impact of flexible encapsulation of organic solar cell by roll-to-roll process on both initial efficiency and mechanical stability. Thanks to a peeling technique, a quantitative analysis of the mechanical strength of each interface was performed. To improve the weakest interfaces, some improvement ways have been tested and this study have shown that better interfaces within the device can induce an improvement of overall performance of the device and their resilience to roll-to roll encapsulation. Finally it is interesting how the encapsulation system can improve the lifetime of the complete device and correlate these results to intrinsic stability of solar cell. This is the latest level of stability. This study concerns also organic solar cell. Different ageing conditions (inert atmosphere and 85°C/85%RH) and two encapsulation processes (roll to roll and sheet to sheet) have been studied. The use of imaging techniques (photoluminescence, laser beam induced current) have proved very useful to investigate the degradation mechanisms induced by water and oxygen. The two last studies performed for encapsulated organic cells can be easily transposed to perovskite cells.

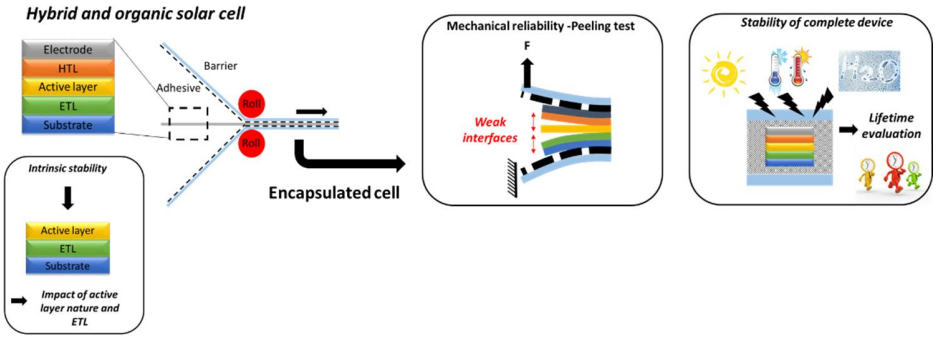

Figure 1: Overview of stability of hybrid and organic solar cell