Fabio Matteocci, J Nucl Ene Sci Power Generat Technol 2016, 5:5 (Suppl)
http://dx.doi.org/10.4172/2325-9809.C1.002

Organometal-halide perovskite solar cell: High efficiency, up-scaling process and stability

Fabio Matteocci
University of Rome "Tor Vergata", Italy

Since three years, perovskite-based photovoltaic devices grew up to 22% in terms of conversion efficiency. Up scaling and stability issues are still under evaluation to validate its role as promising candidate to compete with the other thin-film photovoltaic technologies. In this work, we show the results obtained regarding the main hot-topics such as: High efficiency, up-scaling and stability. Large area (1cm^2) test PSCs were fabricated by using an optimized solvent engineering approach achieving an average efficiency of 13.5% with a best efficiency of 15.4%. The scaling up from small area (0.1 cm^2) to large area PSCs resulted in an efficiency loss of only 9%, with an efficiency of 17.1% for the best small area PSC. Regarding the up-scaling process, we optimized the realization procedures scaling up the process up to 100 cm^2. The results show a best efficiency of 13% on 10 cm^2 as active area, 12.5% on 60 cm^2 and 9% on 100 cm^2, respectively. The issues related to the up-scaling are also discussed by changing the perovskite deposition from spin-coating to blade-coating techniques. Furthermore, we tested the stability of high efficient mesoscopic $CH_3NH_3PbI_3$ perovskite solar cell (PSCs) after the development of a cost-effective encapsulation technique. The main degradation factors (temperature, humidity and light exposure) were evaluated using long-term stability tests such as: Shelf life (>1000 h, RT @ 30RH%), humidity test (>100 h, 40-50°C @ 95RH%), thermal test (>250 h, dark condition, 60°C and 85°C) and light soaking test (>200 h, MPP condition). The results show the intrinsic stability of the $CH_3NH_3PbI_3$ perovskite structure and doped Spiro-OMeTAD. The devices maintain more than 70% of the initial efficiency after shelf life, humidity test, thermal test at 60°C and light soaking test. This shows the beneficial effect of the proposed sealing procedure. The intrinsic degradation is still present due to the instability of the active layers. To understand some degradation effects, scanning transmission electron microscope was used and elemental mapping was acquired through energy-dispersive X-ray analysis on aged cells. Finally, we report the main stability issues related to the intrinsic stability of both $CH_3NH_3PbI_3$ perovskite and Spiro-OmeTAD materials.

Biography

Fabio Matteocci received the Master's degree in Electronic Engineering in July 2009 and completed his PhD in July 2014 from University of Rome "Tor Vergata". Since 2014, he is working as Post-doc to develop an up-scaling process for hybrid thin film devices using perovskite and 2-D materials such as graphene and MoS2. Recently, he joined as a Researcher at the University of Rome "Tor Vergata" in the Electronic Engineering Department. He has published more than 20 papers in high-impact scientific journals and has participated as Speaker to important conferences based on the renewable energy field.

fabio.matteocci@gmail.com

Notes: