

Thin film flexible barrier multilayers by magnetron plasma polymerization

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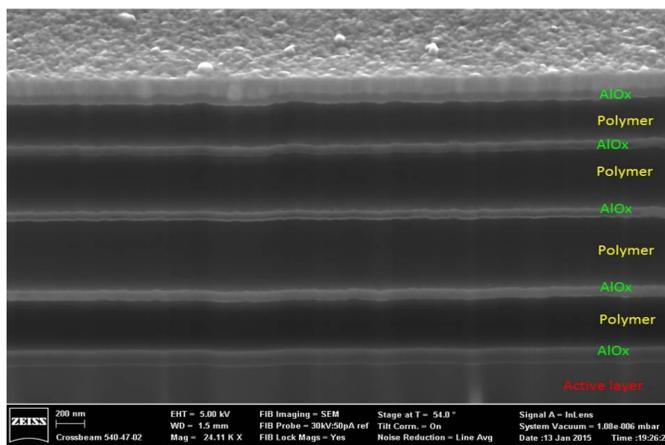


Abstract

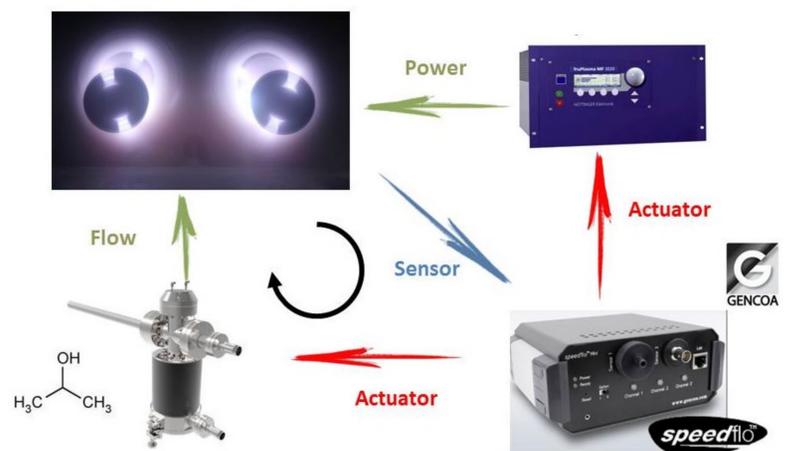
This paper presents data on the application of magnetron plasma sources and pulsed monomer injectors for thin film barrier encapsulation. The process offers an easy upscalability maintaining control for large area production. Multilayers of different nature and composition were deposited, studied and applied to thin film perovskites solar cells.

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Flexible Barrier multilayer



Plasma polymerization + Reactive sputtering process



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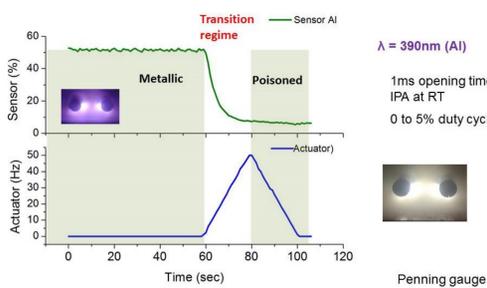


Nano4Energy also offers and develops innovative products for plasma processing making your production more efficient while increasing quality.

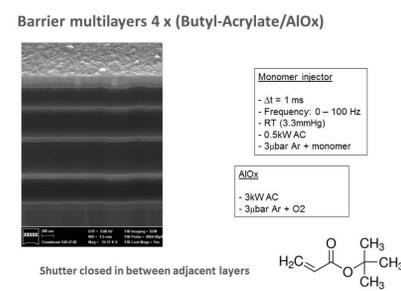
Thin film barrier encapsulation

A pulse monomer effusion cell has been developed and combined with a rotatable magnetron plasma source. The magnetron cathode is used for both the inorganic AlOx layer deposition and plasma polymerization of the injected monomers. The controls were carried out using a Speedflo-Mini™ reactive sputtering controller. Barrier multilayers with good performance were deposited onto PET substrates and halide perovskite solar cells.

Operational principle : OES Control loop



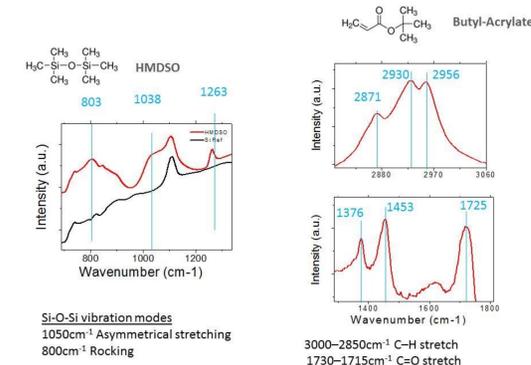
Process sequence



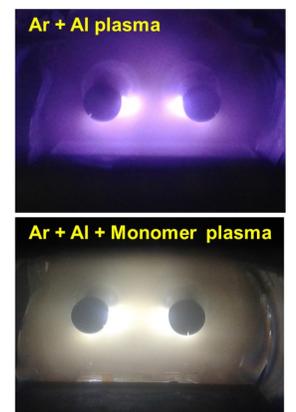
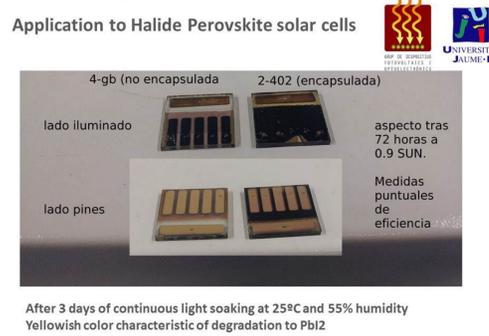
Barrier multilayers on PET



FTIR spectroscopy



Barrier performance



Conclusions

This paper demonstrates a process for the production of thin film barrier multilayers, combining magnetron plasma sources and pulsed monomer injectors. Multilayers of different nature and composition were deposited, studied and applied to thin film perovskites solar cells. The perovskite solar cells encapsulated by the presented process showed to maintain its structural properties when subjected to the conditions in the environmental chamber.

References

- [1] US 2003/203210 patent: Barrier coatings and methods of making same, Vitex Systems, Filing date April 30, 2002
- [2] Graff, G.L., Williford, R.E., and Burrows, P.E., "Mechanisms of vapor permeation through multilayer barrier films: Lag time versus equilibrium permeation." J. Appl.Phys. 1840 (2004).
- [3] R.D. Arnell, P.J. Kelly, Surface and Coatings Technology 112 (1999) 170-176

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