One step Slot-die coated hybrid halide perovskites for photovoltaic application: layer thickness, morphology and surface coverage.

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In the last few years, lead halide based perovskite solar cells have shown an incredibly rapid increase in performance. In 2012, solid state perovskite based solar cells showed a conversion efficiency over 10%[1], after just one year of improvements of materials and device architectures, the target efficiency of 20% was already considered realistically achievable[2]. These results, coupled with the relative earth abundance of materials used as precursors, suggest that this technology is a real low cost competitor to the well-established silicon based photovoltaics. Several research groups are looking for a way to scale-up this promising technology adopting different deposition techniques including those that are roll-to-roll (R2R) compatible[3].

In this work we demonstrate the use of slot-die coating to deposit, in one step and in air, thin films of hybrid halide perovskites (Fig. 1) testing different experimental conditions. The layers obtained have been characterized through microscopic (optical and SEM), X-ray diffraction (XRD, see Fig.2) and profilometric measurements in order to evaluate them and find the experimental setup to obtain layers suitable for photovoltaic applications. Most of efforts have been spend in the control and optimization of the substrate wetting and perovskite crystallization process.

Fig. 1: one step slot-die coated hybrid halide perovskite

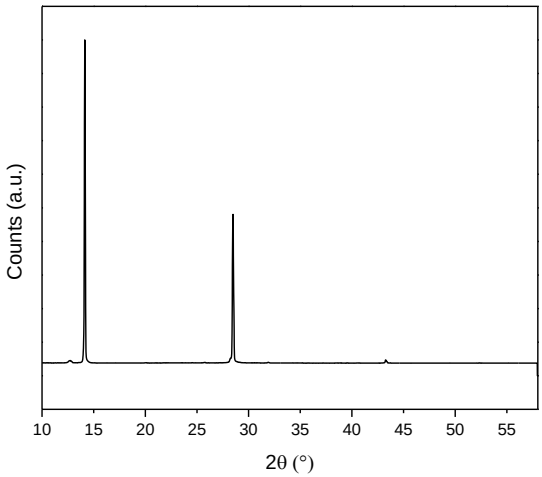

Fig. 2: XRD spectrum of one step slot-die coated hybrid halide perovskite.

This study brings some important indications on the use of the one step method for the large scale production, through slot-die coating, of perovskite solar cells. The authors would like to thank the EPSRC and TSB for supporting this work through the SPECIFIC Innovation and Knowledge Centre.

References

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