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Third generation solar cells from laboratory to factory; Developing a scale-up route for perovskite solar cells to turn 'Buildings into Power Stations'

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Whilst the photovoltaic performance of perovskite solar cells continues to increase, technology developments are also progressing in the area of printing and processing in order to realise large scale manufacture. Possible methods for both depositing the layer stack and its subsequent heating are numerous; to deliver a working and scalable device stack can require a hybrid approach where multiple techniques are employed. This paper introduces a series of technology developments required to enable the continuous fabrication of perovskite solar cells at commercial scale. These include (i) achieving appropriate crystallisation dynamics of the perovskite layer by tuning the printing process, substrate temperature and post processing and (ii) addressing the bottlenecks in manufacture such as reducing annealing times to seconds instead of hours to ensure compatibility with a continuous manufacturing environment and (iii) Choosing the right substrate, glass, metal or plastic that is suitable for the appropriate application. A layer by layer approach to coating deposition will be presented including the mechanism and process parameters required to successfully deposit the entire device stack via screen printing, slot die coating or a hybrid of both on glass and metal substrates. The application of building integrated PV to novel steel framed buildings will be used as an example of where printed PV can potentially transform the built environment into a net positive energy producer.

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