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Towards low-cost manufacturing of organic solar cells: multi-criteria assessment of fabrication technologies

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Extended abstract

One of the most exciting areas of research over the last decade has been organic photovoltaics, a promising technology candidate for very low cost solar electricity. Since the development of semiconducting polymers, these materials have become a potential substitute of traditional semiconductors and metals in functional devices.

In this kind of solar cells sunlight is absorbed by the active layer, made of a blend of polymer and fullerene derivatives as donor and acceptor materials, respectively. The polymer donor material yields an exciton that has to diffuse to the donor/acceptor interface. Given that the deposition of these organic materials could be from solution, organic solar cells have recently gained considerable attention. This potential advantage offers the possibility of patterning the films in high-throughput roll-to-roll techniques, which could seize on the well-known actual industry of plastic packaging techniques.

The main purpose of this work is to evaluate the available film-forming techniques, allowing for a judgement as to the suitability of a given technique in the field of polymer solar cells. Quantitative and qualitative parameters, such as technical issues, environmental impact or reproducibility of the fabrication output, have been taken into account in the study. The assessment of the operation parameters of these manufacturing technologies will lead to propose a low-cost patterning technique suitable for a successful high-volume manufacturing of full organic solar cells.

Multi-criteria decision making methods (MCDM) were used to model the problem of fabrication technique selection, to provide support to the decision-maker. These methodologies are needed to manage with decision problems, where there exist several non commensurable and conflicting criteria. MCDM were therefore combined with fuzzy numbers which served us to assess the criteria valued with linguistic labels.