Synthesis of Conjugated Polymers for Solar Cells and Thermoelectric Devices

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The huge shift in energy consumption requires renewable energy technologies like solar cells (SCs). Organic SCs are gaining interest due to their structure flexibility, very good processability and inexpensive device fabrication. Bulk heterojunction (BHJ) is the key concept OSCs with an active layer consisted of a blend of donor, usually a low bandgap D-A conjugated polymer like Diketopyrrolopyrrole (DPP) containing polymers and an acceptor (fullerene or non-fullerene). Its optimization, and stack design, lead to power conversion efficiencies (PCEs) to around 18% in single-junction solar cells. [1] The electronic properties could be enhanced via new donors like metallooligomers: Pt (II)-containing poly(aryleneethynylene) polymers based on DPP due to their optical and optoelectronic features induced by the inclusion of platinum Pt in the main chain. It has a beneficial impact on solar cell performances as demonstrated with our recent work with PCE=13.26%. [2] Organic thermoelectric (OTEs) have attracted interest recently. Utilization of OTEs could be considered as an innovative source of energy by convert to heat waste into useful energy. However, their usage is limited because a system requires n-type and p-type conjugated, but n-type conjugated polymers are still rare and suffer from low electron mobility and ambient stability in comparison to their counterpart p-type. [3] This research project aims to improve the PCE of DPP-based metallooligomers by working on polymerization conditions, side chain engineering and functionalization of donor units. These donors are of our interest, where they could also be used with strong acceptors for the synthesis of low lying LUMO narrow bandgap n-type conjugated polymers with high electron mobility and a better ambient stability for OFET and OTE (after doping) applications.

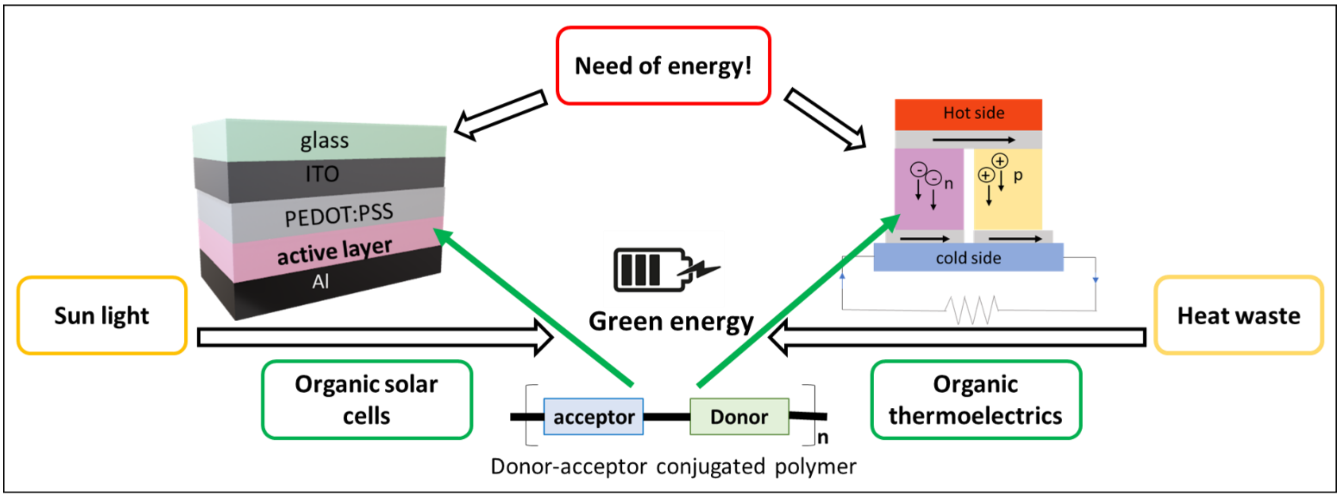

Figure1: scheme illustrating the general aspect of organic conjugated polymers utilization

References

[1]. Ram, K.S.; Ompong, Rad, D.; Setsoafia,D.D.Y.; Singh, J.; *Phys. Status Solidi A* **2021**, *218*, 2000597

[2]. Marineau-Plante, G.; Nos, M.; Gao, D.; Duranditti, M.; Hardouin, J.; Karsenti, P-L.; Gupta, G.; Lemouchi, C. ; Le Pluart, L.; D. Sharma, G.; D. Harvey, P.; *ACS Appl. Polym. Mater*. **2021,** *3, 2,* 1087–1096
[3]. Wang, Y.; Hasegawa, T.; Matsumoto, H.; Mori, T.; Michinobu, T.; *Adv.Mater*.**2018**, *30*, 1707164