Self-organized Metallooligomers for Organic Solar Cells

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Nowadays renewable energy technologies attract a lot of attention due to the limitation of fossil fuel. One of the best renewable energy harvesting devices is organic solar cells (OSCs) as bulk heterojunction cell (BHJ). The active layer is composed of a blend of donor (D) usually a narrow bandgap conjugated polymer and an acceptor (A) like fullerene ($PC_{61}PM$, $PC_{71}BM$) or non-fullerene (IT-4F, Y6). Tremendous efforts have been devoted to increase the power conversion efficiencies (PCE) over 18%[1]. Recently metallooligomers containing Pt(II) metal based on DPP (diketopyrrolopyrrole) are well used, since they display additional optical and optoelectronic features that leads to ultrafast photoinduced electron transfer and the increase of excitons population[2].

The optoelectronic properties of OSCs can be enhanced by tuning the electronic structure of DPP to enhance electronic transfer between donor and acceptor and improving π-π inter-chain aggregation by self-assembly to favor charge carrier's mobility. The benefic impact of organizing groups triphenylene was highlighted with a PCE increasing from 7% to 13.26%[3]. To enhance the optoelectronic properties and the PCE% of solar cells (>15%), my project consists in improving the self-organization of the metallooligomers by ① using different nature and length of the spacer to increase organizational flexibility and solubility, ② changing the nature of organizing group to target face-on π-stacking orientation with different type of mesogenic groups like calamitic or discotic ones, we also worked to install various terminal functions ③ to graft easily the suitable organizing groups.

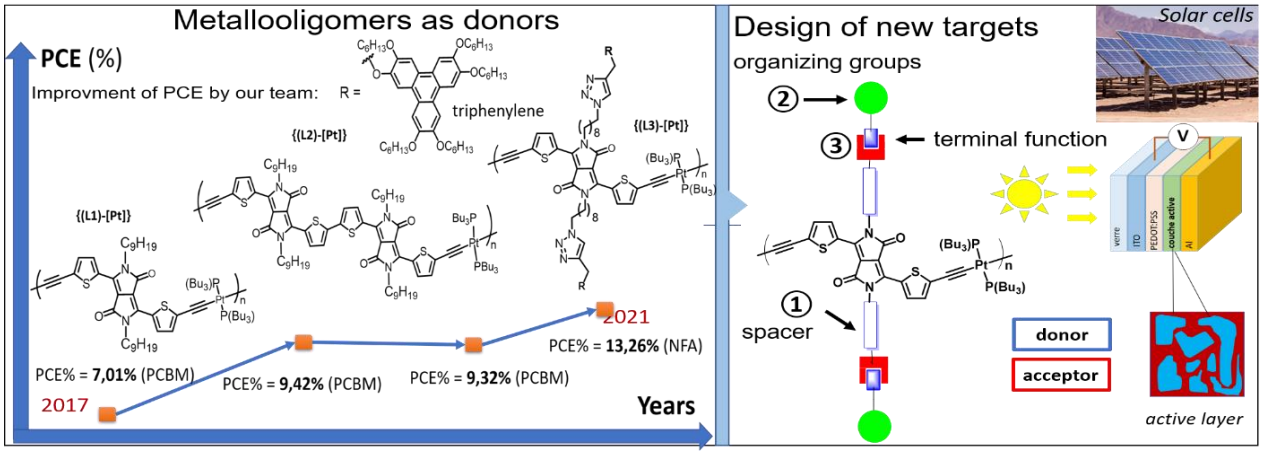

Figure 1: metallooligomers synthesized by our team and the design of the new targets to enhance optoelectronic properties

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