Organic Synthesis Driven by Iron-Catalysis and Applications for Functional Materials

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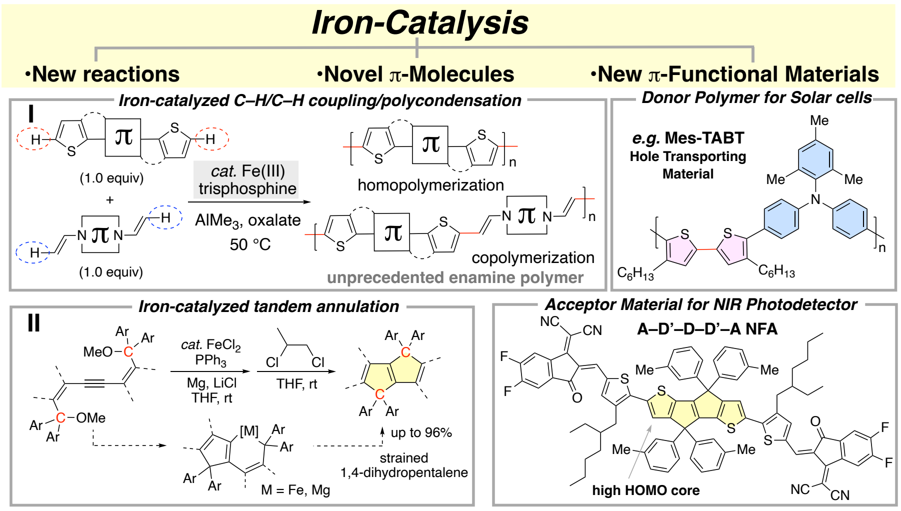
As the most abundant metal on the Earth, iron is ideal to be used as a catalyst for the synthesis of conjugated organic molecules to develop electronic materials. After studying iron catalysis[1] followed by developing conjugated π-materials for several years, we realized that several unique properties of organoiron species, most essentially the low redox potential for iron catalyst turnover and the mechanism of Fe(III)-deprotonative C–H cleavage[2] endows iron-catalysis the advantages for the synthesis of largely conjugated π-molecules, in particular, molecules of high HOMO levels that are difficult to access by traditional methods. Based on this understanding, we developed two new types of iron-catalyzed transformations for accessing conjugated molecules, namely C–H/C–H couplings[2] for polycondensation,[3,4] and tandem annulation[5] to construct strained 1,4-dihydropentalene frameworks. These transformations enabled the expedient synthesis of a variety of conjugated polymers and small π-molecules of materials interest. Several new molecules made by the developed iron catalysis were discovered to be high-performance materials for application in perovskite solar cells[6] and organic photodetectors.[5]



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