

BHJ-based solar cells. It was found that the PDI pendants tended to  $\pi$ - $\pi$  aggregate with other nearby PDI units in **C11PDI HP** and **C7PDI HP**, even in dilute solution, with large changes in the absorption and emission spectra on going from the monomer to polymer. Such  $\pi$ - $\pi$  stacking in polymer side-chains could be largely suppressed by the incorporation of functional groups in the bay positions. However, this resulted in poor OFET and OPV performance for **N-PDI HP**, despite the fact that it showed a broader and more red-shifted absorption spectrum relative to those of **C11PDI HP** and **C7PDI HP**. The OFETs based on **C11PDI HP** and **C7PDI HP** gave electron mobility of up to *ca.*  $5 \times 10^{-5} \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$  after thermal annealing. In the solar cells made from the P3HT:PDI HP blends, devices based on **C11PDI HP** exhibited moderate performance with a PCE up to  $0.38 \pm 0.02\%$  without optimization. This value is among the highest reported PCEs for PDI/P3HT blends. The study of P3HT:PDI HP blends with KPSM indicates more favorable morphology from P3HT:**C11PDI HP** blends over P3HT:**C7PDI HP** blends, including a much smoother surface and possible small domain size. This may provide useful information for further design of donor–acceptor type diblock copolymers with PDI-based pendants. In summary, the current study indicates that **C11PDI HP** blended with P3HT shows better performance in solar cells than the other two polymers. **C11PDI** will be chosen as the building block in preparing the D–A type diblock copolymers shown in Chapter 3.

## 2.10 Experimental section

**General:** Most organic and inorganic chemicals in this chapter were obtained from Aldrich, Alfa Aesar, and TCI and used without further purification. 1-Undecyl-