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Controlled phase separation in conjugated polymer blends using quadruple hydrogen bonding interactions[1] YEN-HAO LIN, RAFAEL VERDUZCO, Rice University — All-polymer photovoltaic blends have significant promise for low-cost, solution processed photovoltaics, but large-scale phase separation can lead to non-optimal active layer structures for charge-separation and transport. We propose a novel strategy for controlling phase separation in conjugated polymer blends using quadrupole hydrogen bonding interactions. We investigate a series of end-modified conjugated and coil-like polymers in blends, including poly(3-hexyl thiophene) (P3HT), poly(styrene), poly(ethylene glycol), poly(9,9-dioctyl fluorene). Polymers are end-terminated with the multiple hydrogen bonding group 2-ureido-4(1H)-pyrimidinone (UPy) using isocyanate chemistry. Atomic force microscopy and grazing incidence x-ray scattering show phase separation is suppressed and, in some cases, P3HT crystallite orientation is improved in films for blends of UPy functionalized polymers. These results show the quadruple hydrogen bonding groups can prevent large-scale phase separation and direct the orientation of polymer chains.

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