Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Molecularly Isolated Perylene Diimides Enable Both Strong Exciton-Photon Coupling and High Photoluminescence Quantum Yield

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KEYWORDS: Polariton, Strong coupling, diimide perylene, organic laser

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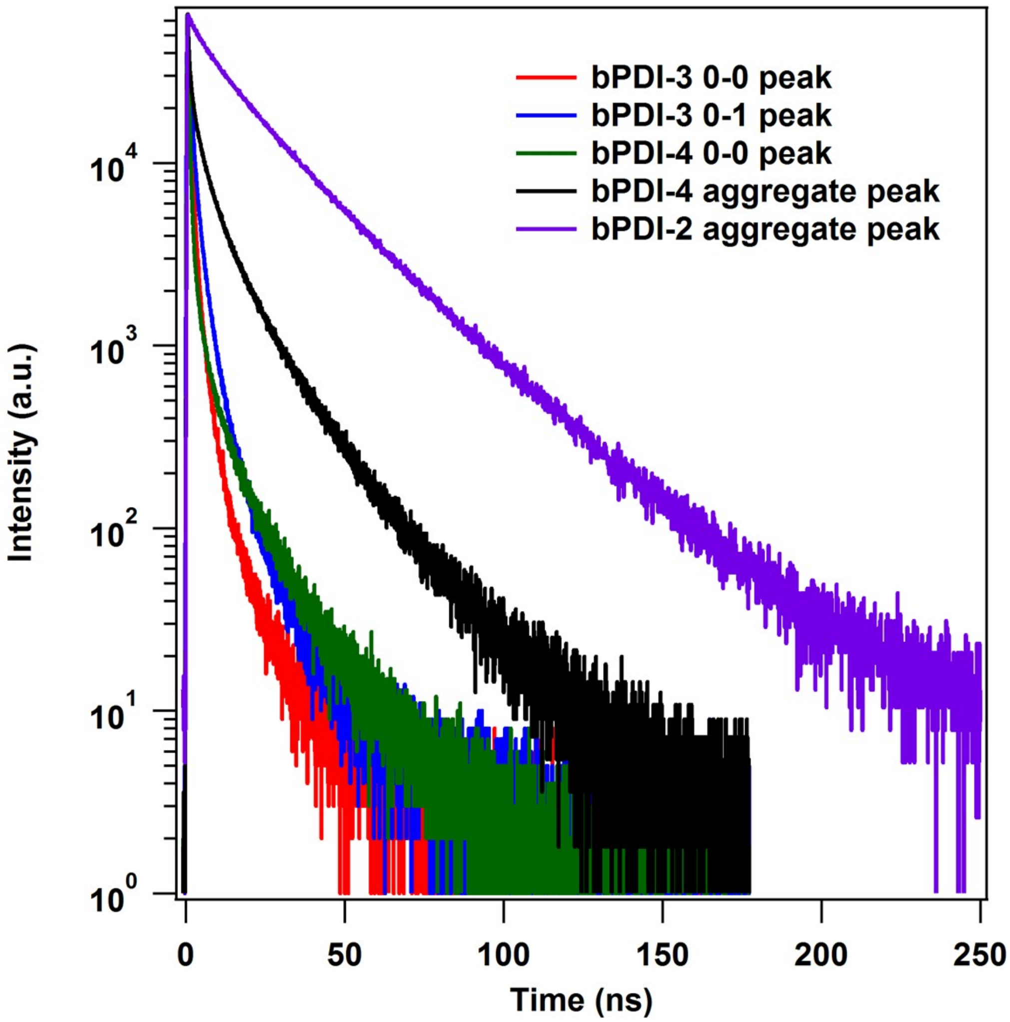


Figure S1: Lifetime data. Kinetic traces of bPDI-2 (120 mM), bPDI-3 (120 mM), and bPDI-4 (60 mM). Due to varying degrees of aggregation, multiple time constants are needed to fit the data. Current work is focused on investigating the large lifetime difference between aggregates of bPDI-4 and the other perylene diimides.

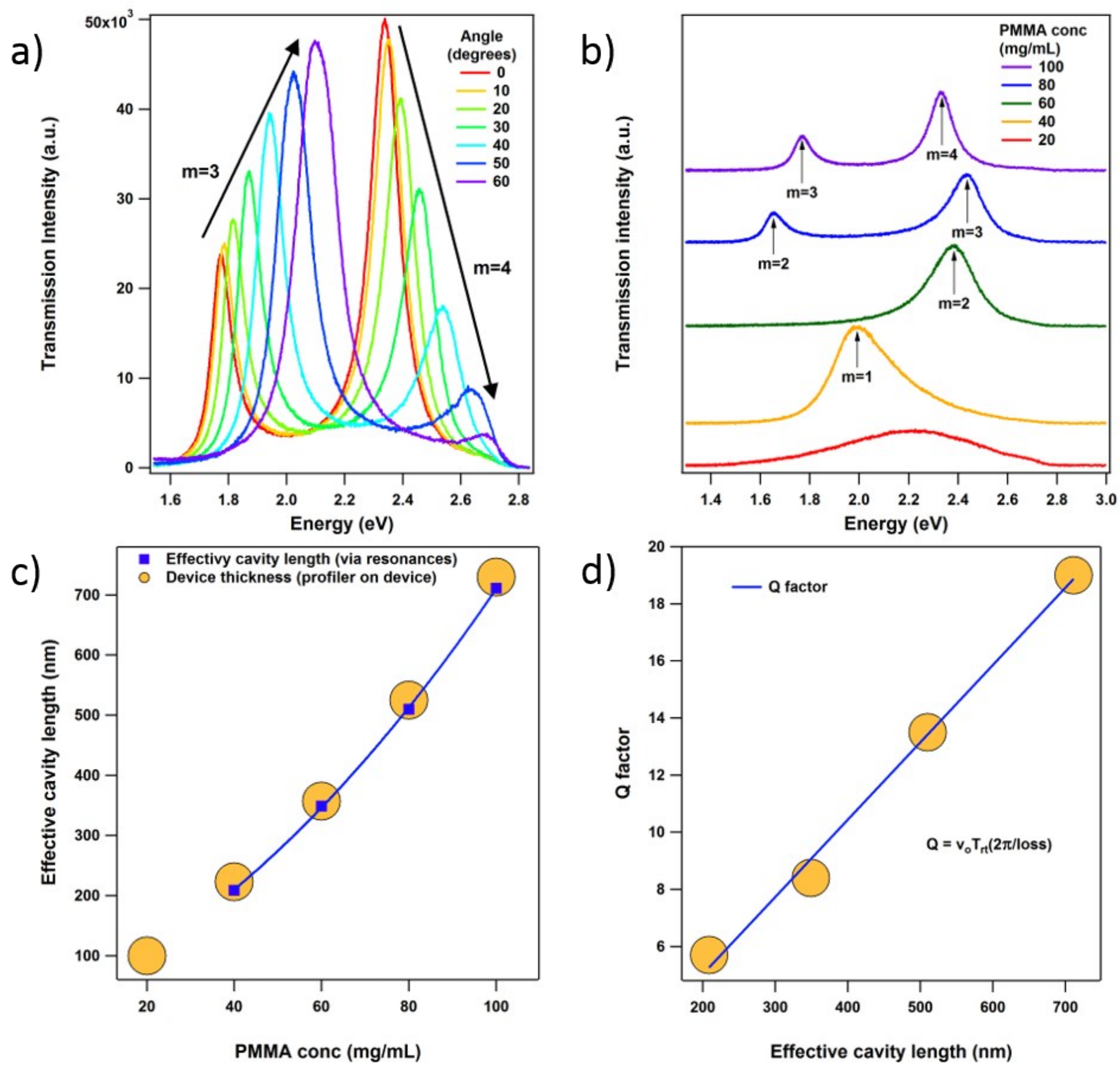


Figure S2: PMMA control device. (a) Angle-dependent transmission spectra of 100 mg/mL PMMA device. Difference in amplitudes are due to the spectral shape of the incident white light source. (b) Mode resonances of the different PMMA control devices. (c) Cavity thickness of different PMMA control devices, tested by both surface profilometry and via the resonances. (d) Q-factor of different PMMA control devices with fit showing a linear dependence.

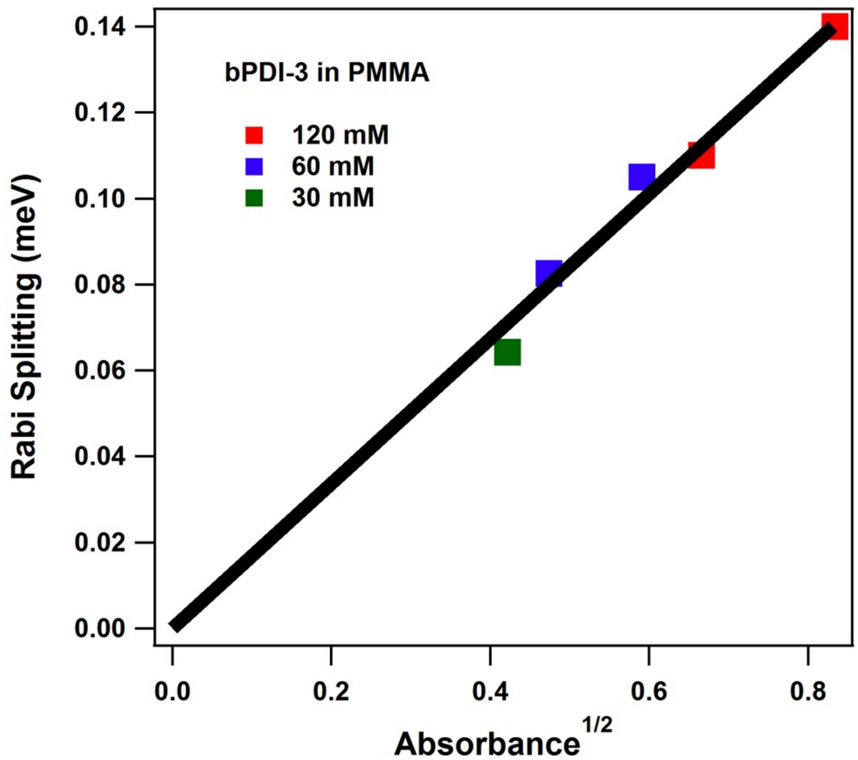
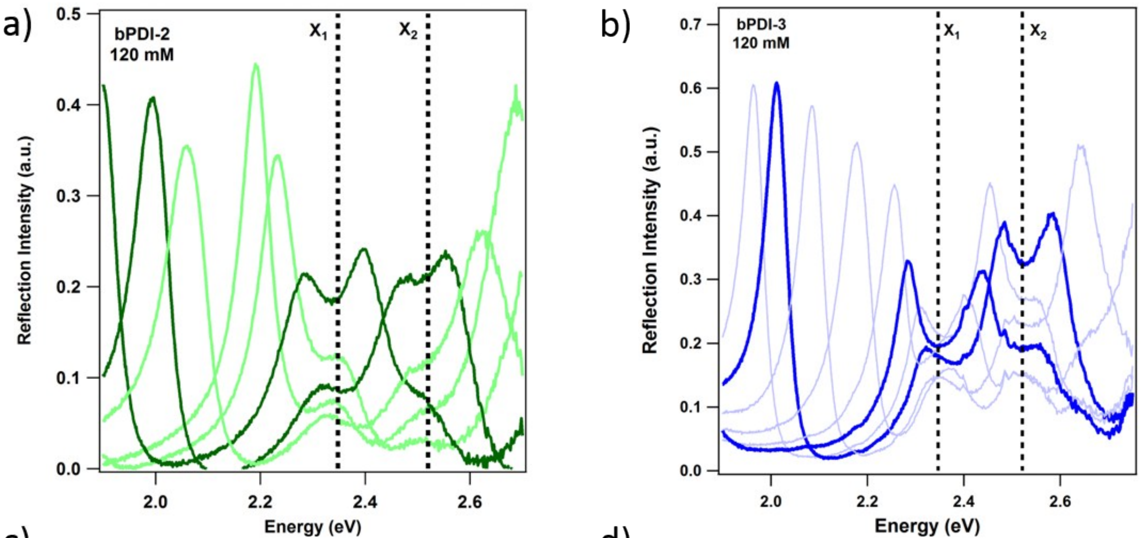
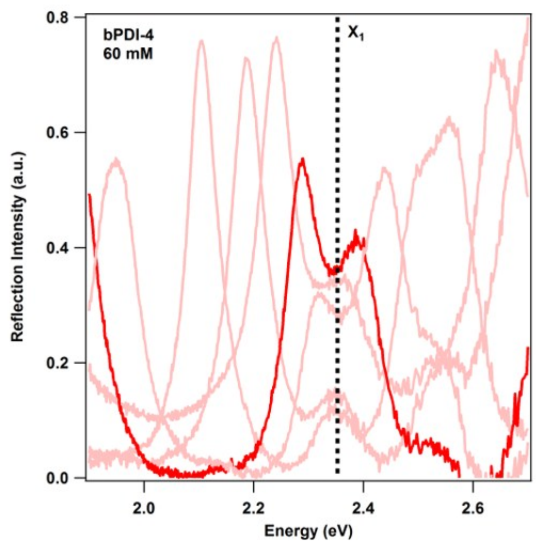


Figure S3: Absorbance length. Rabi splitting value as a function of Absorption$^{1/2}$ for bPDI-3 devices at different dye loadings. Red, blue, and green squares represent 120 mM, 60 mM, and 30 mM dye in PMMA, respectively.

a) b)



c)



d)

Sample	Ω_1 (meV)	Ω_2 (meV)
2 (120 mM)	100	75
3 (120 mM)	140	110
3 (60 mM)	105	83
3 (30 mM)	65	-
3 (15 mM)	-	-
4 (60 mM)	90	-

Figure S4: Dye loading effect. Angle-dependent reflection measurements of (a) bPDI-2 at 120 mM dye loading, (b) bPDI-3 at 120 mM dye loading, and (c) bPDI-4 at 60mM dye loading. (d) We use the coupled oscillator model to reveal the Rabi splitting values for the samples.

Table S1: Comparison

Small molecules doped in a matrix					
Material	**Threshold**	**Ω reported in**	**Ω (meV)**	**PLQY**	**PLQY reported in**
bPDI-3 (120 mM)	-	This work	140 [1]	45%	*Chem Mater.* 2017, **29**, 8395
bPDI-3 (60 mM)	-	This work	105 [1]	62%	*Chem Mater.* 2017, **29**, 8395
bPDI-3 (30 mM)	-	This work	65 [1]	89%	*Chem Mater.* 2017, **29**, 8395
BODIPY (10% dye loading in polystyrene)	527 μJ cm^{-2}	*Adv. Opt. Mat.*, 2017, **5** 1700203	91 [2]	11%	*Adv. Opt. Mat.*, 2016, **4**, 1615
Protein					
eGFP	2,400 μJ cm^{-2}	*Sci Adv.*, 2016, **2**, E1600666	97 [2]	60%	*Biophys. J.*, 1997, **73**, 2782
Crystalline material					
Crystalline anthracene	320 μJ cm^{-2}	*Nat. Phot.* 2010, **4**, 371	128 [2]	94%	*Proc. Phys. Soc. B*, 1995, **68**, 241
Oligofluorene					
TDAF	30 μJ cm^{-2}	*Nat. Mat.*, 2014, **13**, 271	293 [2]	43%	*Adv. Opt. Mat.*, 2013, **1**, 827
Polymer					
MELPPP	500 μJ cm^{-2}	*Nat. Mat.*, 2014, **13**, 247	116 [2]	30%	*Appl. Phys. Lett.*, 1996, **68**, 1090

[1] Reported in silver-silver cavity. [2] Reported in DBR-DBR cavity.

Note: Due to the thickness of our active material, the Rabi splitting should not be affected severely upon changing to DBR-DBR mirror.