Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Supporting information for

N-alkyl substituted *1H*-benzimidazoles as improved n-type dopants for a naphthalene-diimide based copolymer

Thermogravimetry of selected dopants

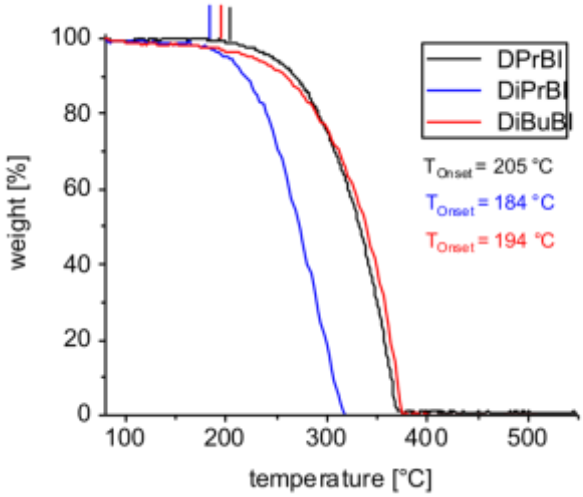

Fig. S1 TGA of DPrBI, DiPrBI and DiBuBI

Differential Scanning Calorimetry

Analysis are carried out with a Perkin-Elmer DSC 8500 equipped with a liquid nitrogen cooling system, Perkin-Elmer CLN2 under N_2 flux at 40 mL/min end set at -45°C.

DMBI

Method used is the following:

1) Heating from 40 °C to 130 °C at 10 °C/min (—)
2) Isoterm for 1 min at 130 °C
3) Cooling from 130 °C to 40 °C at 10 °C/min (—)
4) Isoterm for 1 min at 40 °C
5) Heating from 40 °C to 130 °C at 10 °C/min (—)

Sample weight: 2.841 mg

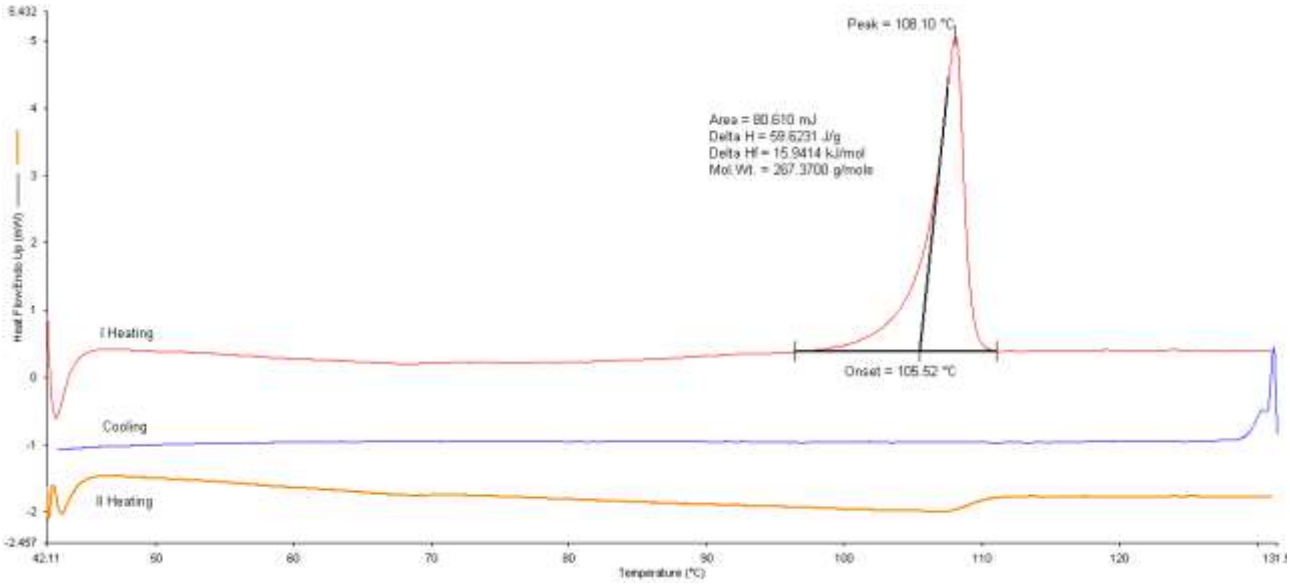

Fig. S2 Thermogram of DMBI

DEtBI
Sample weight: 2.674 mg
Method used is the following:

1) Heating from 25.00 °C to 200.00 °C to 10.00 °C/min (—)
2) Isotherm for 1 min at 200.00°C
3) Cooling from 200.00 °C to 25.00 °C to 10 °C/min (as DMBI sample, not shown)
4) Isotherm for 1 min at 25.00 °C
5) Heating from 25.00 °C to 200.00 °C to 10.00 °C/min (—)
6) Isotherm for 1 min at 200.00°C

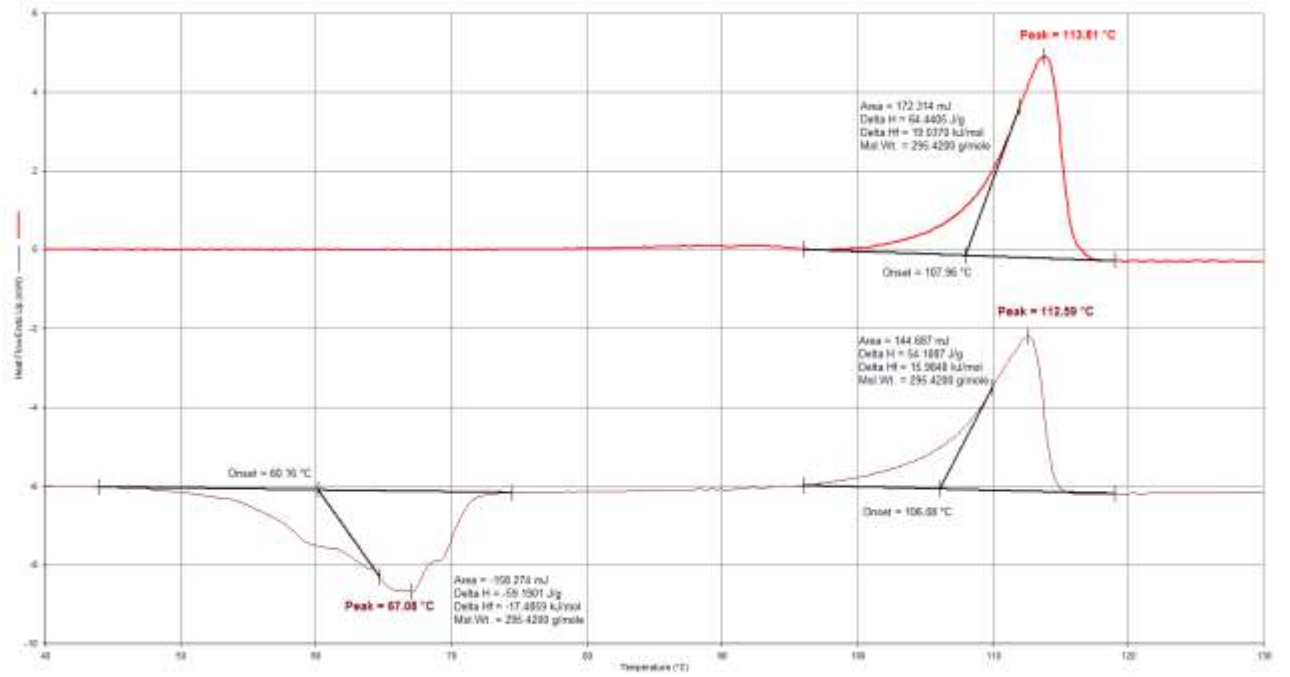

Fig. S3 Thermogram of DEtBI

DPrBI
Method used is the following:

1) Heating from 0 °C to 100 °C at 10 °C/min (—)
2) Isotherm for 1 min at 100 °C
3) Cooling from 100 °C to -20 °C at 10 °C/min (as DMBI sample, not shown)
4) Isotherm for 1 min at -20 °C
5) Heating from -20 °C to 100 °C at 10 °C/min (no phase transition are observed, not shown)

Sample weight: 2.070 mg

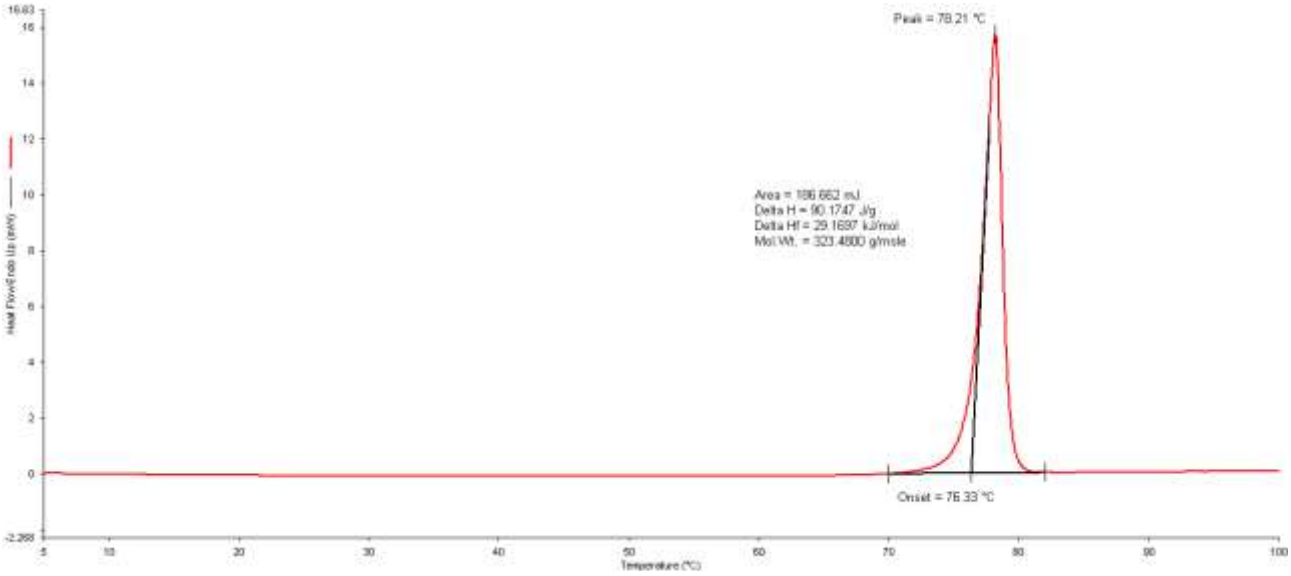

Fig. S4 Thermogram of DPrBI

DBuBI
Method used is the following:

1) Heating from 0 °C to 80 °C to 10 °C/min (—)
2) Isotherm for 1 min at 80 °C
3) Cooling from 80 °C to -20 °C at 10 °C/min (—)
4) Isotherm for 1 min at -20 °C
5) Heating from -20 °C to 80 °C at 10 °C/min (—)

Sample weight: 1.246 mg

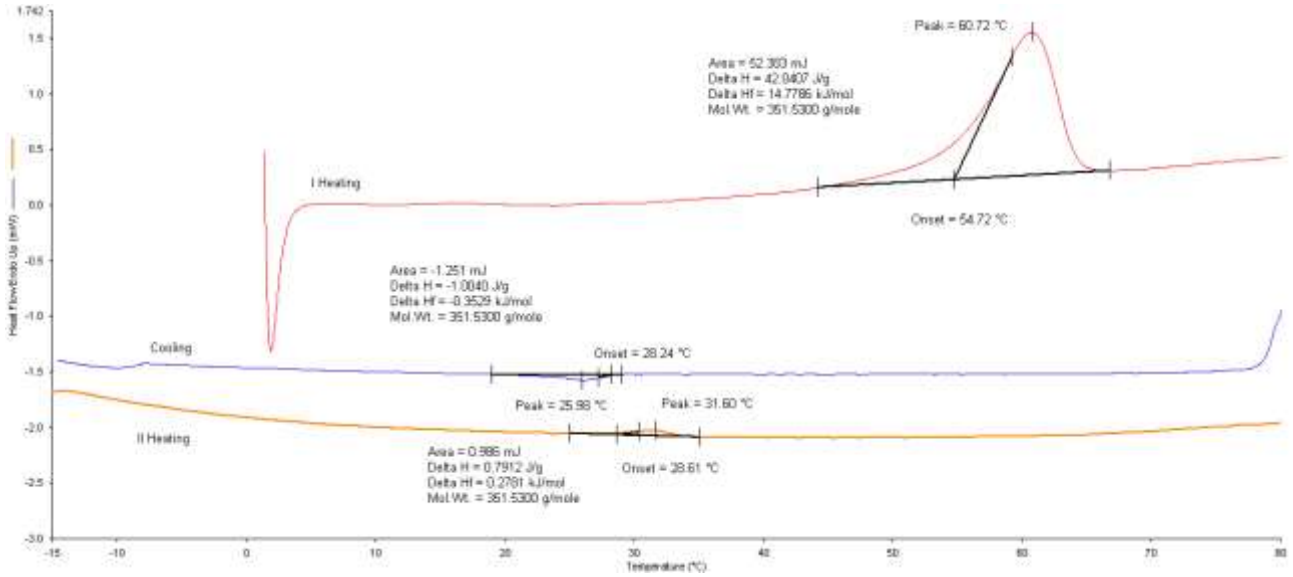

Fig. S5 Thermogram of DBuBI

DiPrBI
Method: same as for sample DPrBI
Sample weight: 0.510 mg

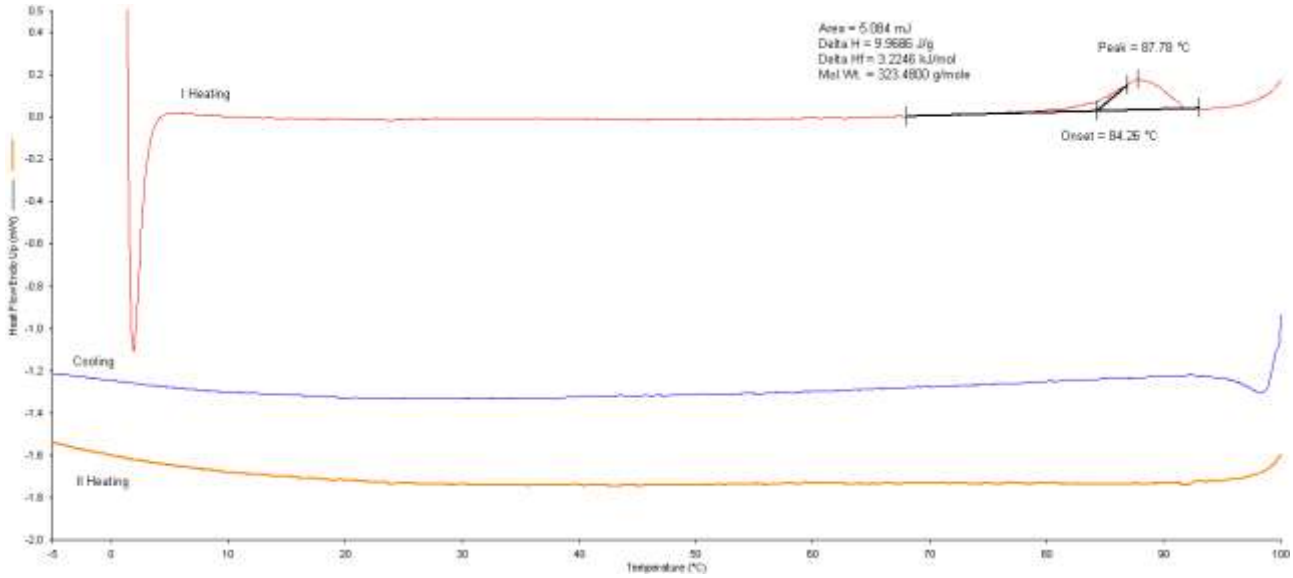

Fig. S6 Thermogram of DiPrBI

DiBuBI
Method: same as for sample DPrBI
Sample weight: 1.441 mg

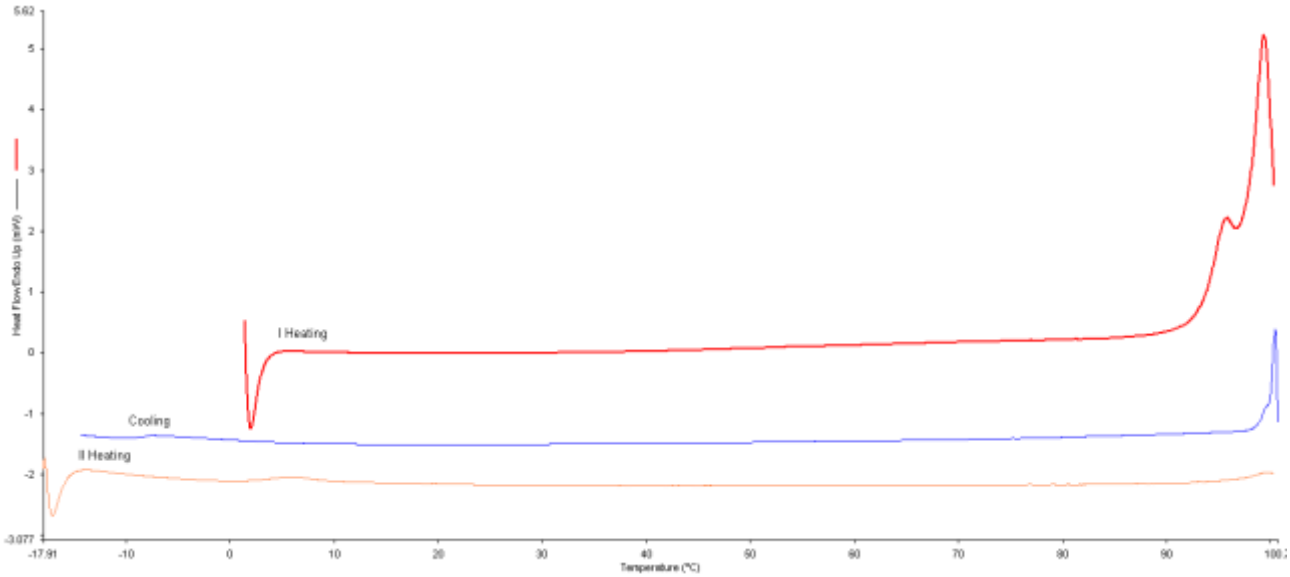

Fig. S7 Thermogram of DIBuBI

Pristine P(NDI2OD-T2)

Module:	DSC	Temperature Program:					
Data Name:	B-PN2R-pol-part.dsc		Cel	Cel	Cel/min	min	s
Measurement Date:	19-Nov-12	1*	-20	140	10	0	0.5
Sample Name:	PN2R polimero di partenza	2*	140	-20	10	0	0.5
Sample Weight:	4.050 mg	3*	-20	370	10	0	0.5
Reference Name:		4*	370	-10	10	1	0.5
Reference Weight:	0.000 mg	5*	-10	350	10	0	0.5
		6*	350	30	10	1	0.5

Comment:
Operator: Valerio
Gas1: Nitrogen
Gas2: Air
Pan: Aluminum
Strutturale

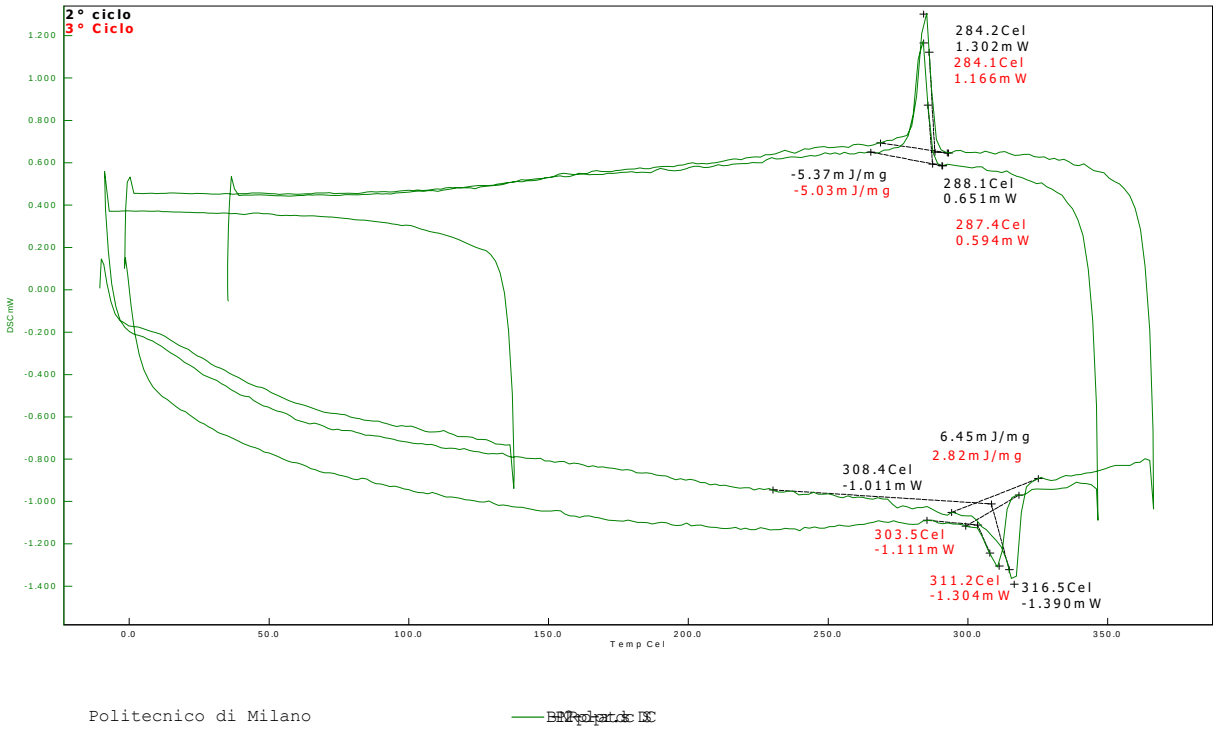

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Fig. S8 Thermogram of pristine P(NDI2OD-T2)

DSC of doped polymer films

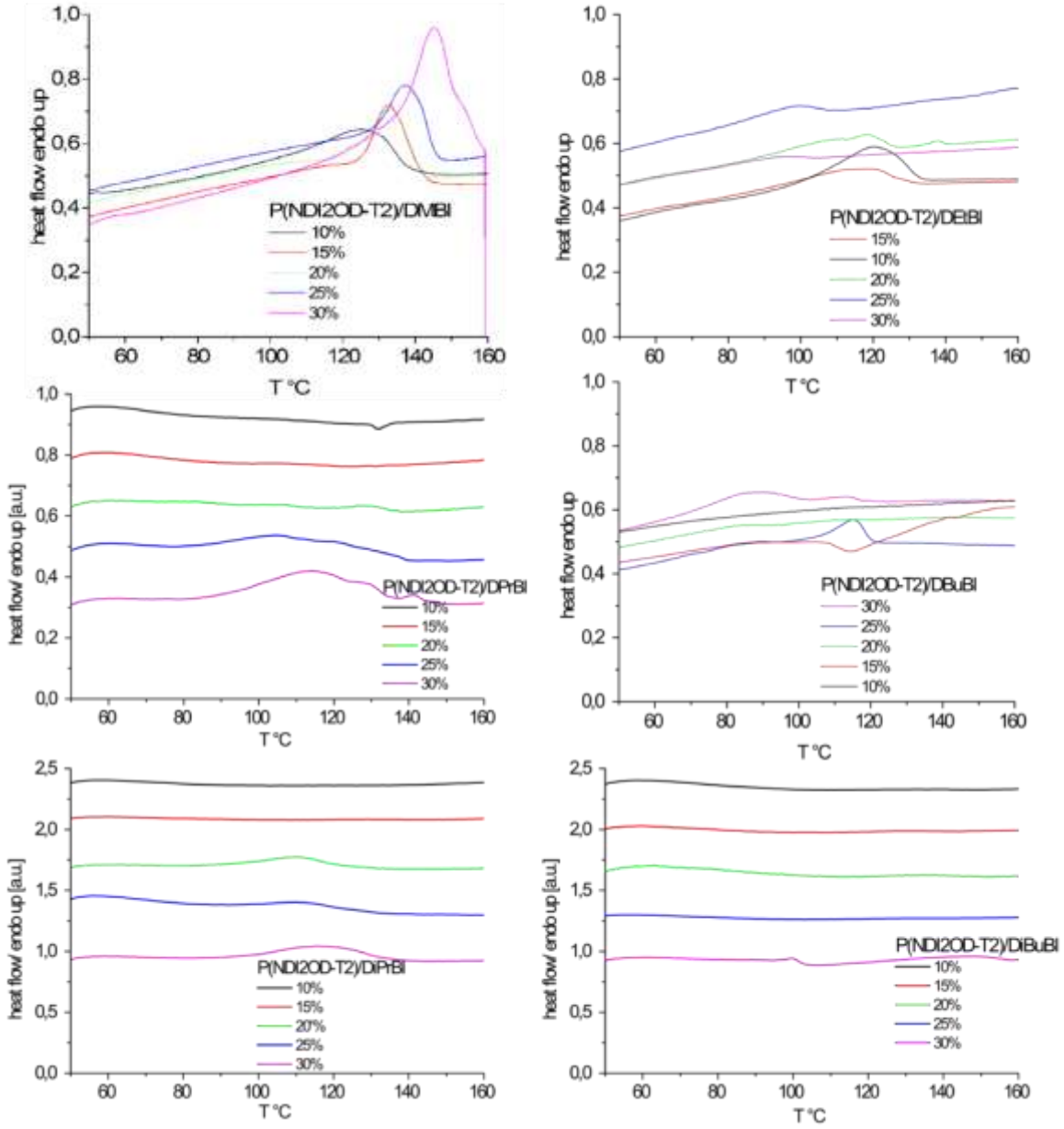

Fig. S9 Thermograms of doped polymer films for all the dopants. For every dopant, 10 %, 15 %, 20 %, 25 %, 30 % concentration were analysed. The curves shown are the first heating curves of the blends measured at 10 K/min under N_2.

Variable Temperature Electrical Conductivity Measurements

Instrumentation

Analysis is carried out using an Agilent Technologies semiconductor parameter analyzer (SPA) working in vacuum and equipped with a liquid nitrogen cooling system. The temperature range studied is between 200K and 300K, scanning with steps of 10K. I-V curves were taken for each step using a 4-point-probe collinear method in order to eliminate the effects of contact resistance. Then, for each curve, the value of the corresponding electrical conductivity was determined.

Variable Range Hopping (VHR) fitting

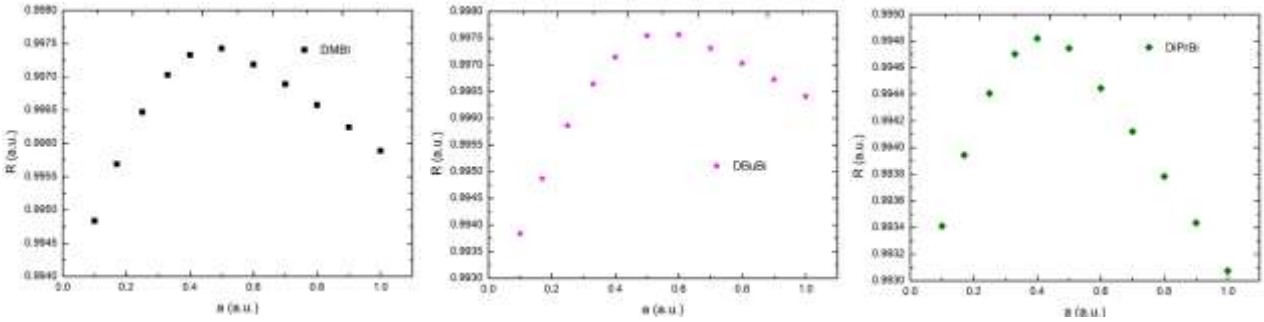

Fig. S1 Residual vs α to determine the best fitting for the three dopant molecules

The fitting of the Arrhenius plot for the three dopant molecules was done using Matlab Software through the linearization of the VRH model (Eq. 1) in order to calculate the value of the α exponent which gives the best fitting.

$$\ln \sigma = -A\left(\frac{T_0}{T}\right)^{\alpha} + B$$

From the Residual calculations (Fig. S1) it appears that the best fitting corresponds to α=0.5, as already reported in literature, indicating a 1D VRH transport model.

GIWAXS

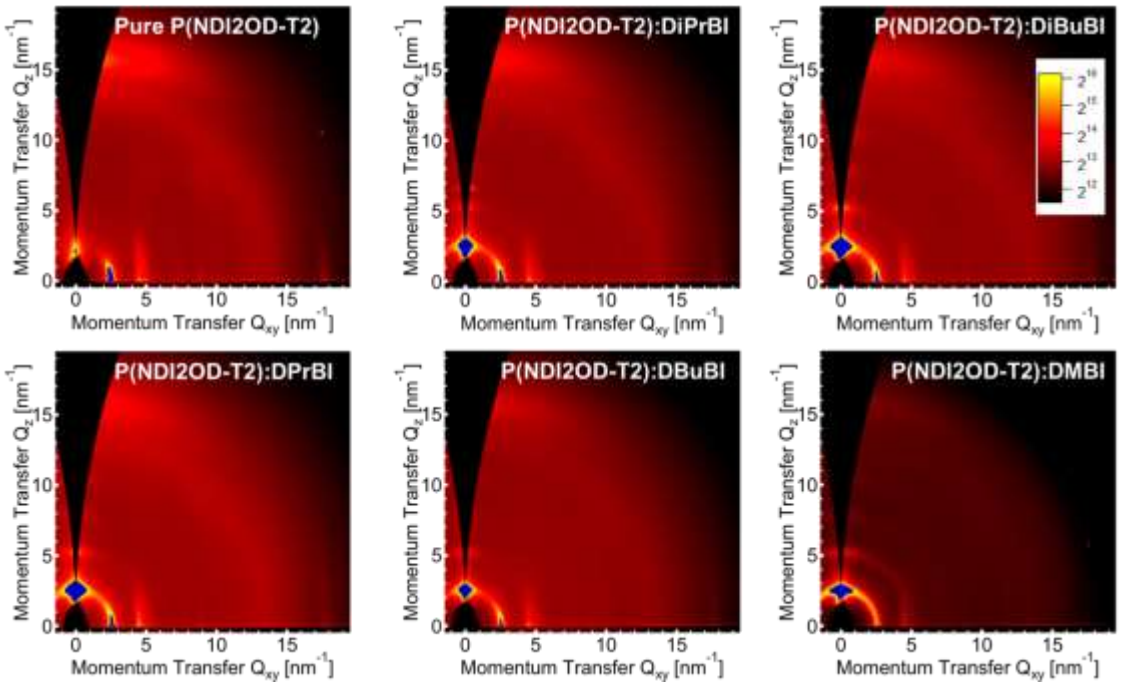

Fig. S2 2D GIWAXS patterns of P(NDI2OD-T2) thin films without and with various dopants.

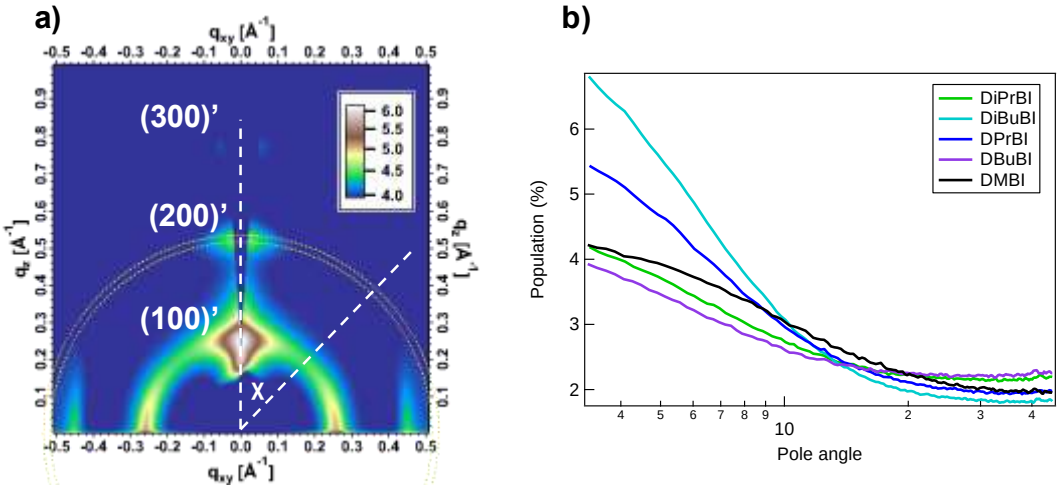

Fig. S3 a) 2D GIWAXS pattern from P(NDI2OD-T2):DiBuBI thin film. The crystallite orientation distribution (COD) profiles were extracted from the circular line cut across (200)', indicated by the thin dash lines. Pole angle χ ranging from 0° to 45° (0° denotes the direction perpendicular to the substrate) was chosen to make sure no overlays between (200)' and other diffraction features. b) COD profiles regarding P(NDI2OD-T2) (200)' under different dopants. The crystallite population was calculated by normalizing the measured diffraction intensity by the integrated total intensity within the pole angle range of interest with the assumption that crystallites from the same crystallographic direction at different pole angles are formed with similar crystallite thickness and lattice disorder.