Supporting Information

Unlocking the Secrets of High-Water Barrier Stereocomplex Polylactide Blend Extrusion Films

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Table of contents

S1. Processing conditions

Table S1 shows the processing conditions in which the film was extruded.

Table S1. Cast Film extrusion parameters used for processing.

Processing temperatures	Temperature (°C)
Zone 1	210
Zone 2	220
Zone 3	230
Transfer tube	230
Adapter	230
Feedblock	220
Die	215
Chill Roll	22

Extrusion Settings	Speed (RPM)
Screw	25
Chill roll speed	10 to 20

S2. Resin Characterization

Table S2 shows the melt flow rate (MFR) of all four resins used in the study.

Table S2. MFR of PLLA and PDLA resins.

	Weight (g/30 sec)	MFR (g/10 min)
PLLA - L130	0.653	13.06
	0.629	12.59
	0.609	12.19
	0.754	15.09
	0.584	11.69
	0.753	15.06
	0.610	12.21
	0.595	11.89
	0.582	11.64
	0.565	11.30
	0.554	11.08
	0.507	10.14
	0.487	9.74
Average	**0.606**	**12.13**
St. Dev.	**0.064**	**1.53**

*190° C and 2.16 kg weight

	Weight (g/30 sec)	MFR (g/10 min)
PDLA - D120	0.619	12.38
	0.512	10.24
	0.483	9.66
	0.736	14.72
	0.661	13.22
	0.570	11.39
	0.507	10.13
	0.626	12.52
	0.494	9.89
	0.738	14.76
	0.751	15.01
	0.604	12.09
	0.598	11.96
Average	**0.608**	**12.15**
St. Dev.	**0.090**	**1.81**

*190° C and 2.16 kg weight

	Weight (g/30 sec)	MFR (g/10 min)
PLLA - L175	0.170	3.40
	0.182	3.64
	0.150	3.00
	0.181	3.62
	0.191	3.82
	0.157	3.13
	0.191	3.81
	0.181	3.61
Average	**0.175**	**3.50**
St. Dev.	**0.014**	**0.28**

*190° C and 2.16 kg weight

	Weight (g/30 sec)	MFR (g/10 min)
PDLA - D070	0.485	9.69
	0.472	9.43
	0.495	9.89
	0.413	8.26
	0.520	10.40
	0.576	11.52
	0.546	10.92
	0.483	9.65
Average	**0.499**	**9.97**
St. Dev.	**0.046**	**0.93**

*190° C and 2.16 kg weight

Table S3 shows the study's thermal and physical properties of all four resins.

Table S3. Physical properties of PLLA and PDLA resins used in the study.

Thermal Properties	PLLA (L175)			n	PDLA (D070)			n
$T_{d,1\%}$, °C	318	±	5	3	314	±	1	3
T_g, °C	78	±	1	3	75	±	0	3
T_m, °C	177	±	1	3	177	±	1	3
X_c, %	37	±	8	3	56	±	19	3
Melt Flow Rate, g/10 min	3.5	±	0.3	8	10.0	±	0.9	8
Physical Properties								
Density, g/cm^3	1.25	±	0.0	9	1.24	±	0.0	9
M_w, kDa	157	±	6	6	38	±	3	6
M_n, kDa	87	±	7	6	22	±	2	6
Đ	1.7	±	0	6	1.8	±	0.1	6

Note: n indicates the number of samples

Thermal Properties	PLLA (L130)			n	PDLA (D120)			n
$T_{d,1\%}$, °C	303	±	5	3	319	±	5	3
T_g, °C	74	±	1	3	72	±	7	3
T_m, °C	176	±	1	3	179	±	1	3
X_c, %	30	±	1	3	30	±	5	3
Melt Flow Rate, g/10 min	12.1	±	1.5	13	12.1	±	1.8	13
Physical Properties								
Density, g/cm^3	1.25	±	0	19	1.25	±	0	12
M_w, kDa	120	±	0	6	101	±	0	6
M_n, kDa	70	±	1	6	59	±	1	6
Đ	1.7	±	0.0	6	1.7	±	0.0	6

Note: n indicates the number of samples

Figure S1 is the thermograms of the PLLA(L130) and PDLA(D120) resins used in the study.

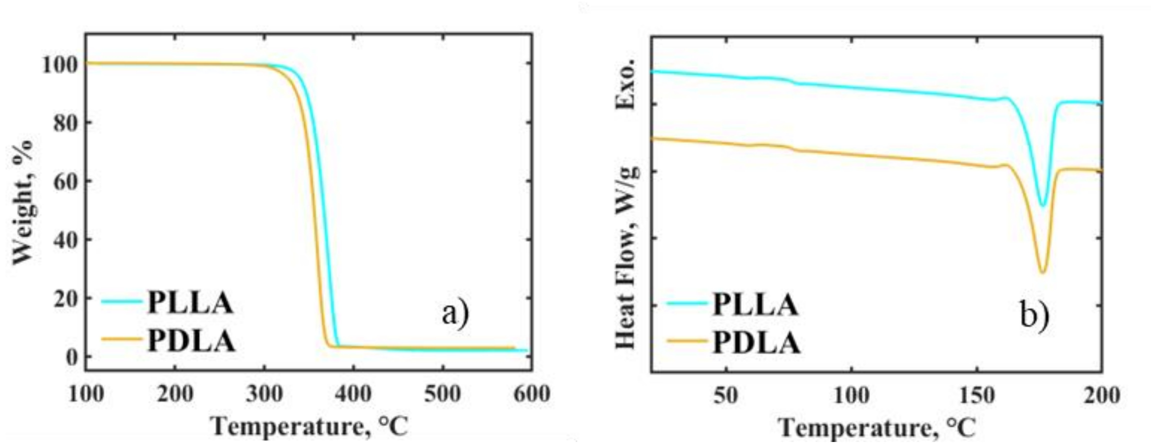

Figure S1. a) TGA of PLLA (L130) and PDLA (D210) resin; b) DSC of PLLA (L130) and PDLA (D120) resin

S3. Films Characterization

Figure S2 is the UV transmission rate versus the wavelength for all the films produced.

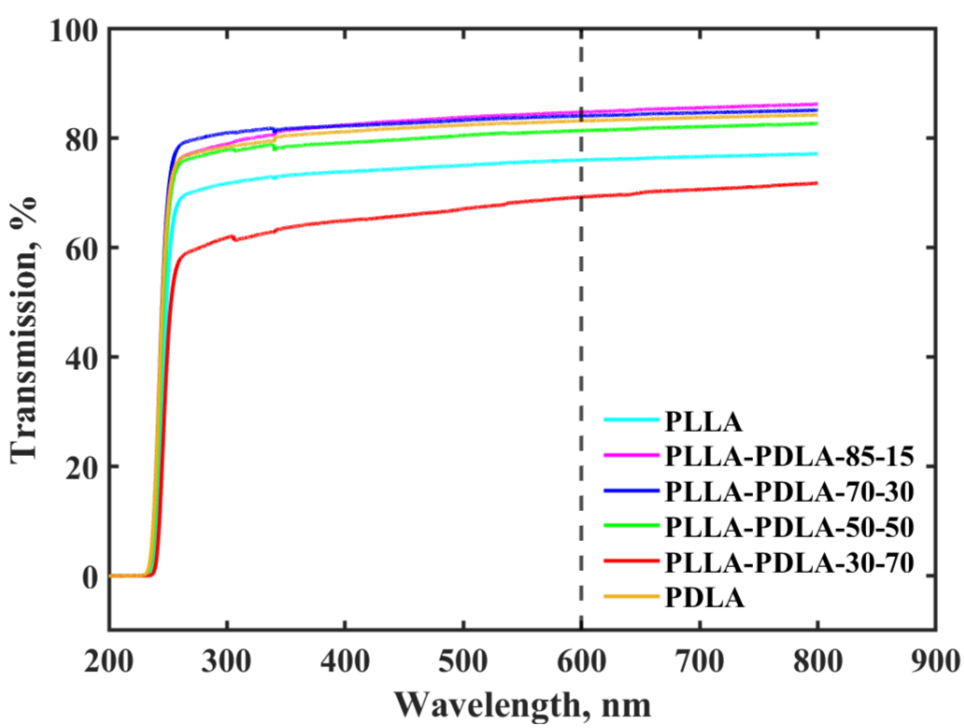

Figure S2. UV transmission rate versus wavelength for the various films at a wavelength of 600 nm.

Figure S3 shows the Tensile Strength of PLLA, blends, and PDLA in CD.

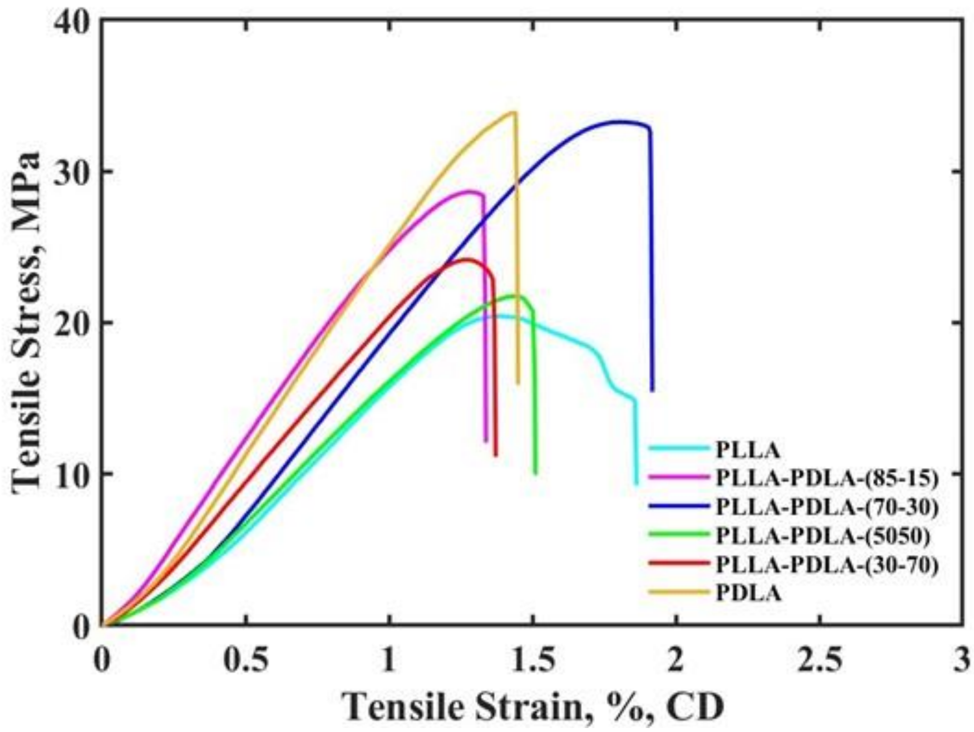

Figure S3. Tensile Strength of PLLA, blends, and PDLA in CD.

Table S4 summarizes all the films' non-annealed tensile stress and strain.

Table S4. Tensile Stress and Strain of PLLA, PDLA and blends, MD, and CD, non-annealed. Values followed by a different letter are significantly different at $P \leq 0.05$ (Tukey test).

	Tensile stress at Maximum load		Tensile strain at tensile strength	
	MD	CD	MD	CD
Material	MPa	MPa	%	%
PLLA - L130-A160 - 0 minutes	36.18 ± 4.36^{b}	19.82 ± 1.96^{e}	2.33 ± 0.11^{f}	$1.45 \pm 0.14^{g,h}$
PLLA/PDLA(85/15)-A160 - 0 minutes	43.97 ± 4.94^{a}	$28.77 \pm 1.15^{c,d}$	2.42 ± 0.22^{f}	1.33 ± 0.10^{g}
PLLA/PDLA(70/30)-A160 - 0 minutes	35.49 ± 2.66^{b}	30.19 ± 3.93^{c}	2.34 ± 0.14^{f}	1.82 ± 0.16^{i}
PLLA/PDLA(50/50)-A160 - 0 minutes	33.43 ± 1.39^{b}	20.61 ± 1.70^{e}	2.25 ± 0.07^{f}	1.56 ± 0.10^{h}
PLLA/PDLA(30/70)-A160 - 0 minutes	33.19 ± 2.74^{b}	$24.04 \pm 1.47^{d,e}$	2.08 ± 0.35^{f}	1.33 ± 0.12^{g}
PDLA - D120-A160 - 0 minutes	41.77 ± 3.05^{a}	32.65 ± 6.00^{c}	2.48 ± 0.24^{f}	$1.44 \pm 0.23^{g,h}$

Figure S4 shows the DSC and WAXD of the other blends, (85/15) and (30/70) PLLA/PDLA.

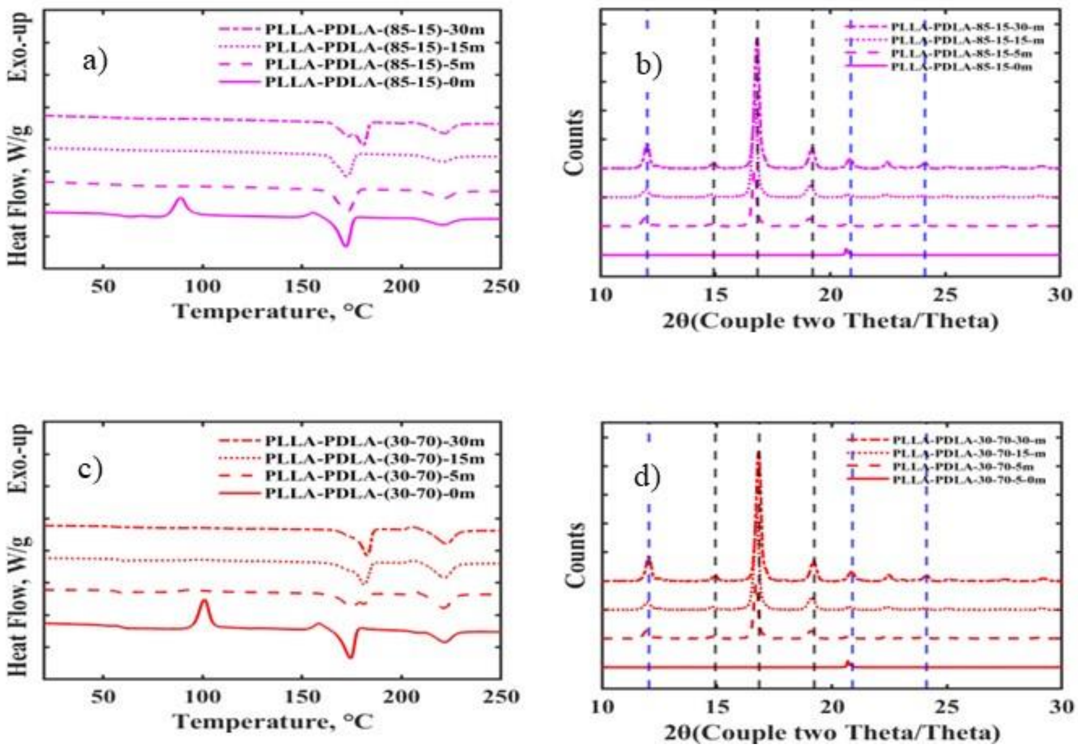

Figure S4. a) DSC of annealed PLLA-PDLA (85/15)-A-0,5,15,30 minutes; b) WAXD of annealed PLLA-PDLA 85/15)-A-0,5,15,30 minutes; c) DSC of annealed PLLA-PDLA (30/70)-A-0,5,15,30 minutes; d) WAXD of annealed PLLA-PDLA (30/70)-A-0,5,15,30 minutes. Note: In the WAXD figures, the dashed black lines represent α-crystals. The dashed blue lines represent SC-crystals.