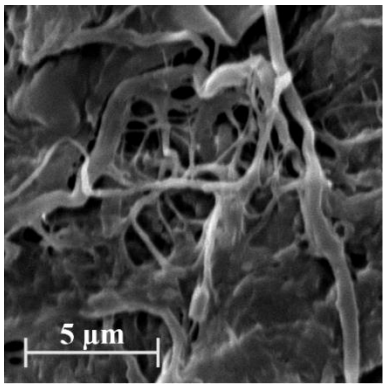

Figure S1. SEM micrograph of the NFC.

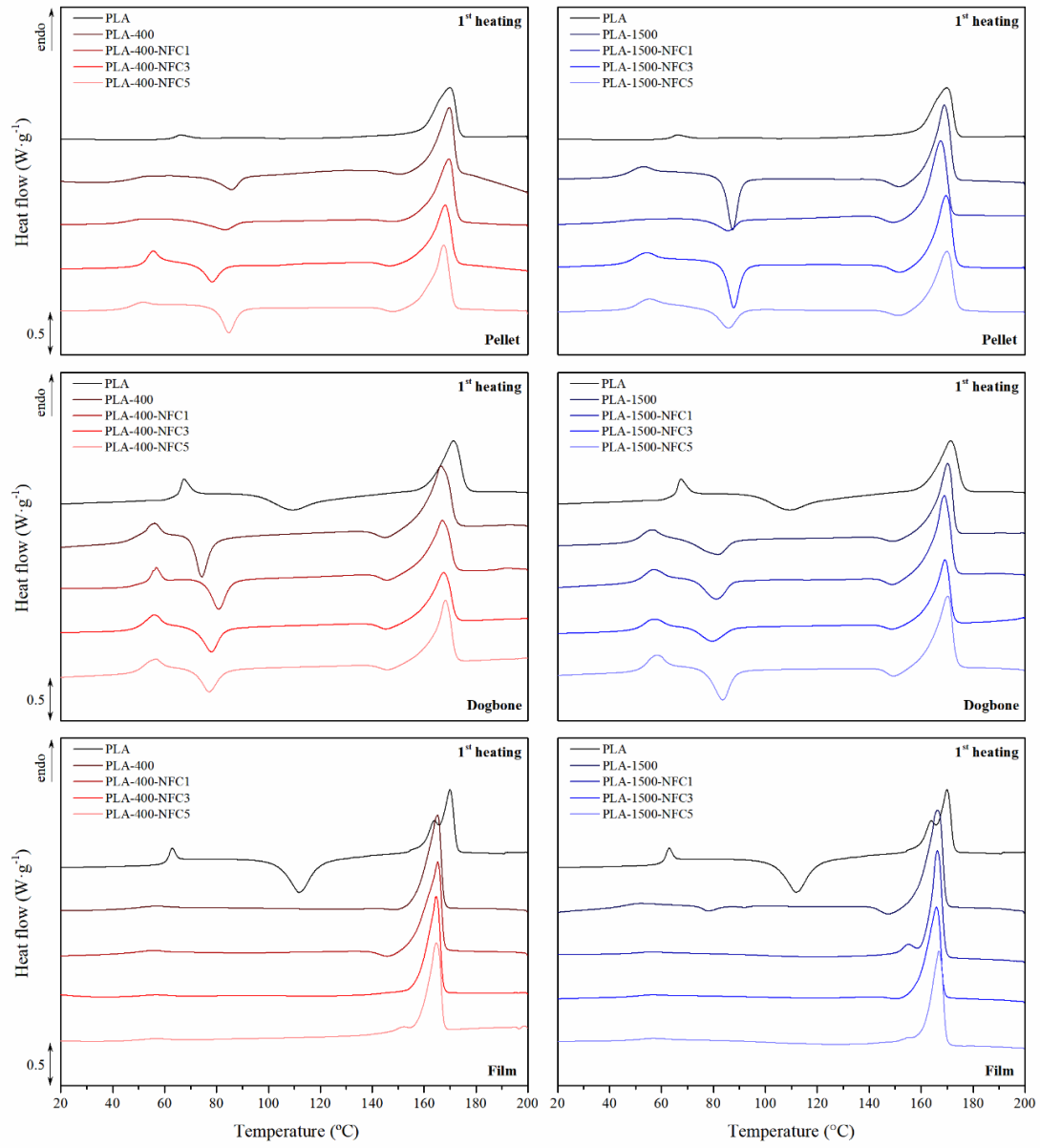

Figure S2. Calorimetric thermograms for the first heating scan of PLA, PLA-PEG blends and PLA-PEG-NFC bionanocomposites after the subsequent stages of compounding, dogbone and film specimen preparation.

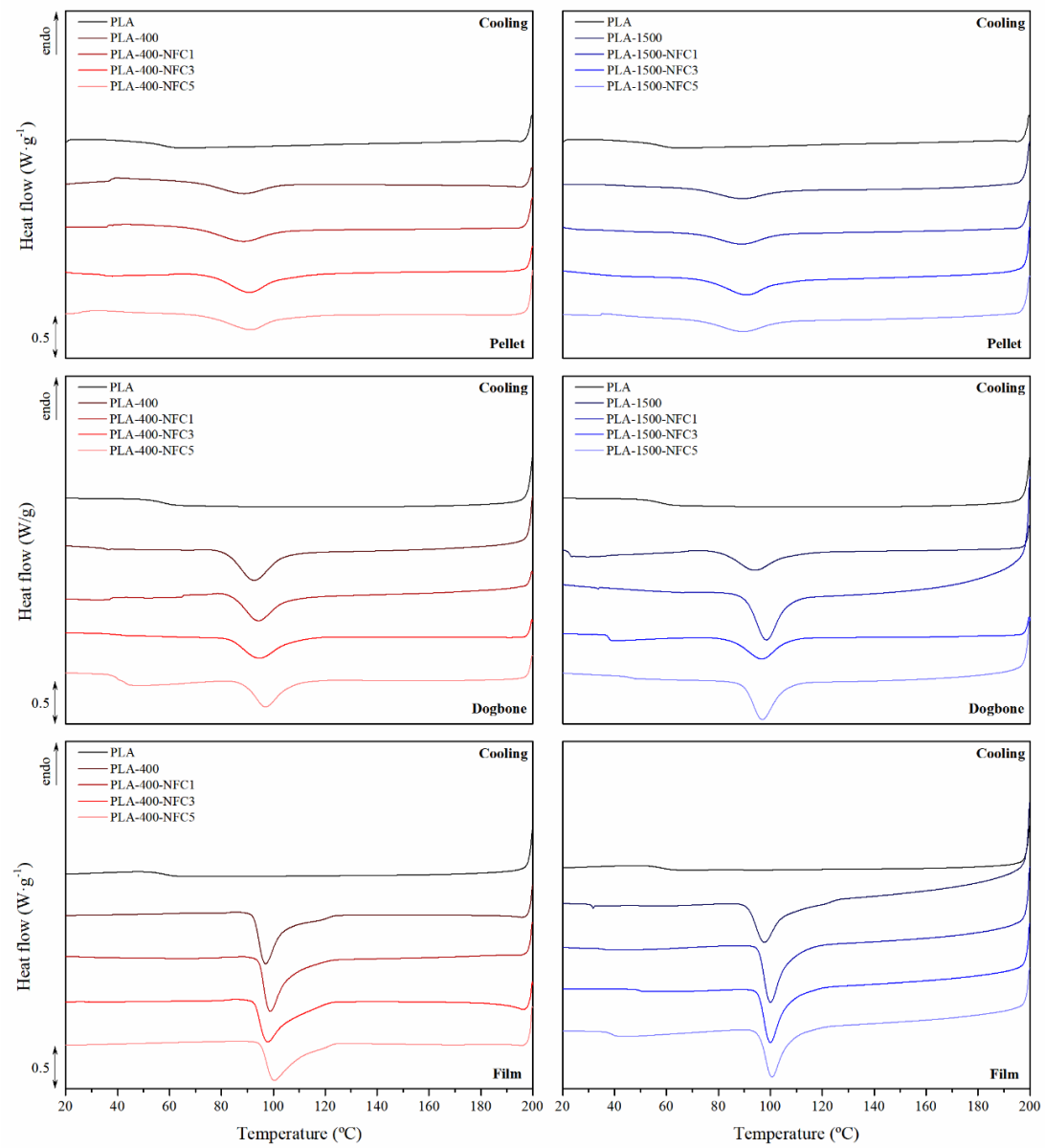

Figure S3. Calorimetric thermograms for the cooling scan of PLA, PLA-PEG blends and PLA-PEG-NFC bionanocomposites after the subsequent stages of compounding, dogbone and film specimen preparation.

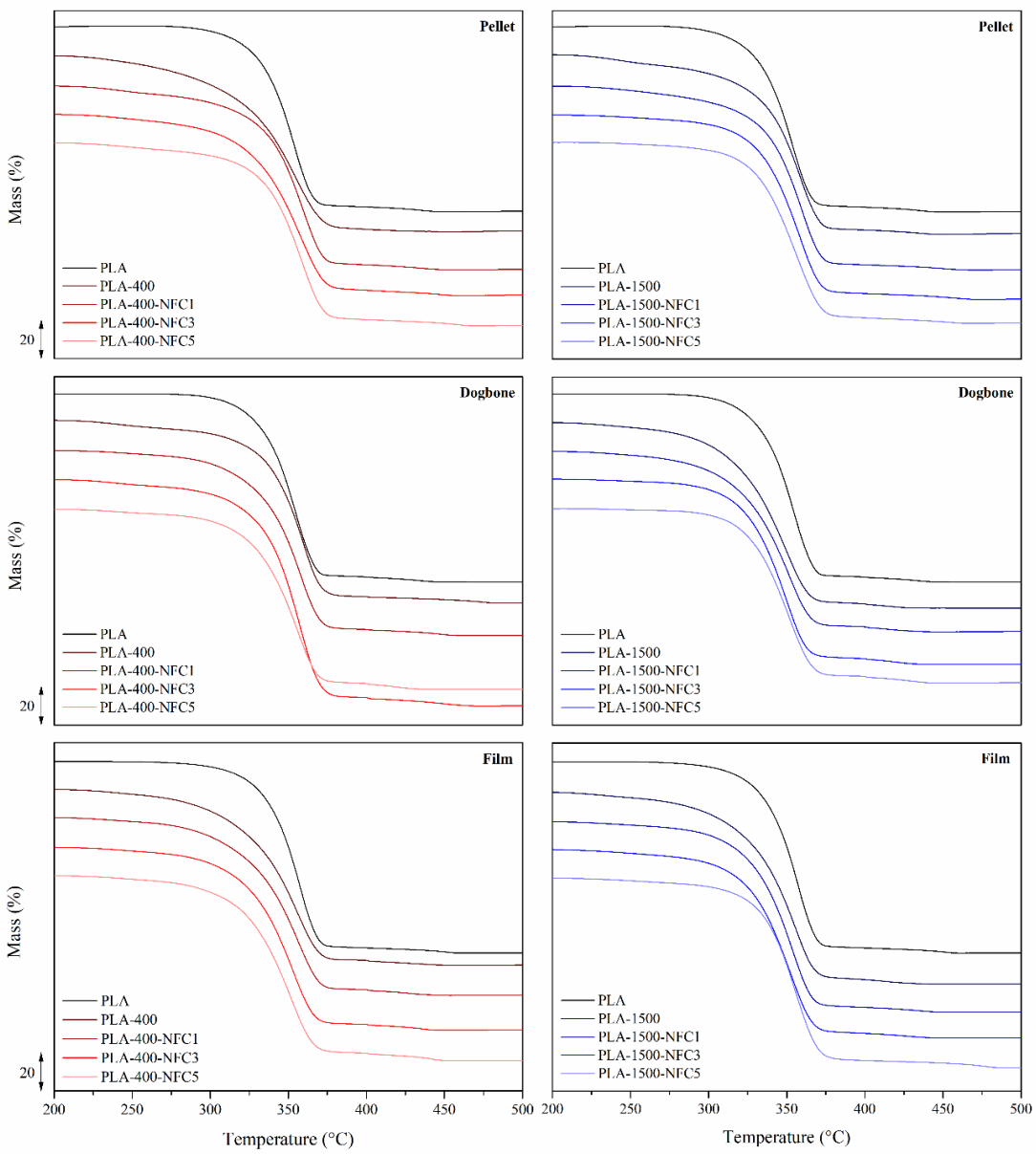

Figure S4. Thermogravimetric thermograms (TG) of PLA, PLA-PEG blends and PLA-PEG-NFC bionanocomposites after the subsequent stages of compounding, dogbone and film specimen preparation.

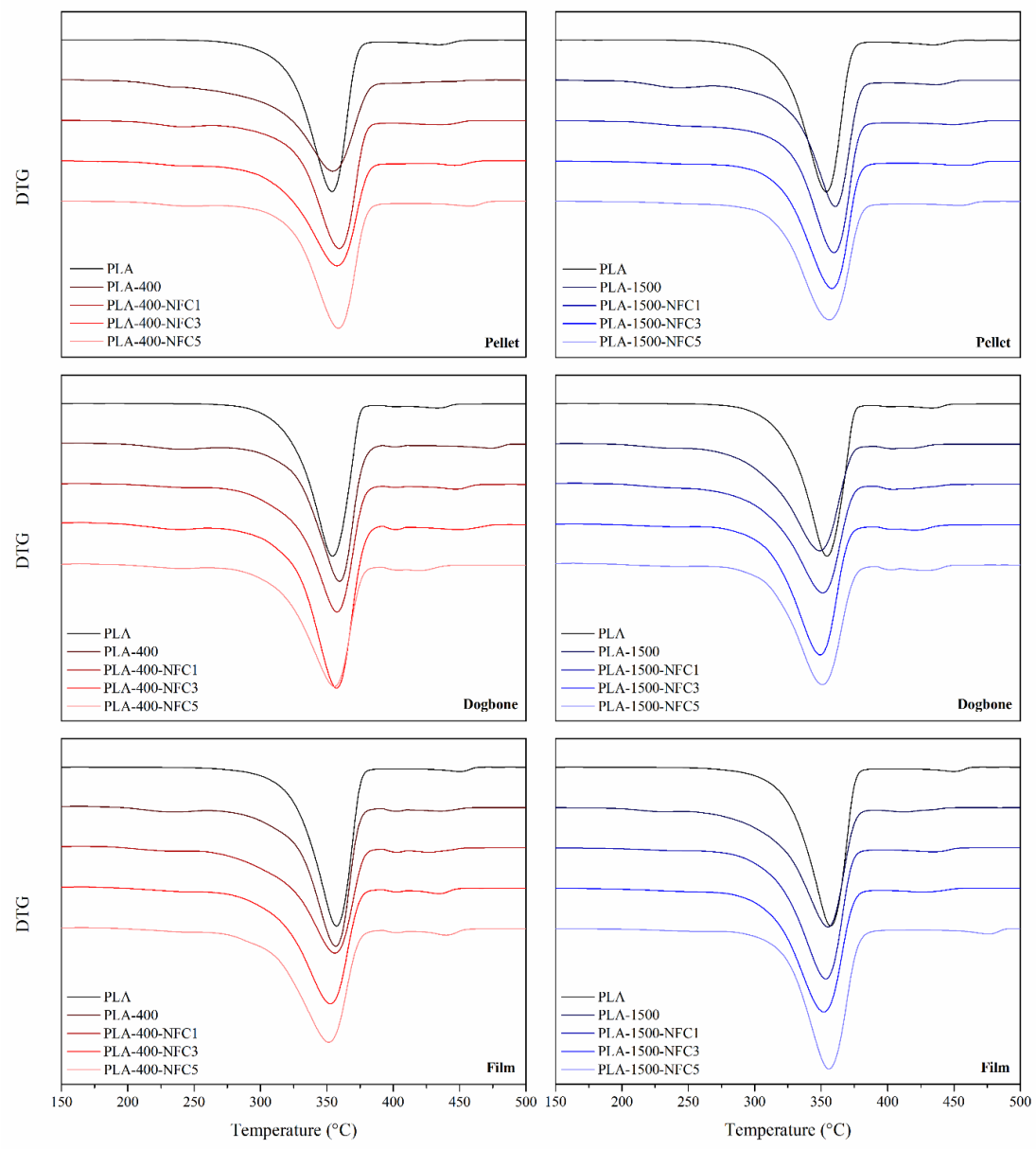

Figure S5. Derivative thermogravimetric thermograms (DTG) of PLA, PLA-PEG blends and PLA-PEG-NFC bionanocomposites after the subsequent stages of compounding, dogbone and film specimen preparation.

Table S1. Key parameters overviewing the structural and morphological consequences of processing in terms of molar mass (M_n, M_w), amorphous/crystalline morphology (T_g, X_c and l_c). *C* stands for compounding, *D* for dogbone and *F* for film specimens.

		M_n (g·mol^{-1})	M_w (g·mol^{-1})	T_g (ºC)	X_c (%)	l_c (nm)
PLA	*C*	56900 (±2700)	115800 (±200)	56.3 (±0.8)	2.2 (±0.6)	13.3 (±0.1)
	D	48800 (±3000)	106100 (±150)	57.2 (±0.5)	11.4 (±1.5)	13.7 (±0.0)
	F	39700 (±200)	76100 (±370)	58.0 (±0.3)	12.5 (±3.5)	14.1 (±0.0)
PLA-400	*C*	55400 (±1100)	87600 (±200)	42.0 (±1.4)	27.4 (±3.4)	13.1 (±0.2)
	D	31500 (±3500)	66000 (±150)	42.0 (±0.0)	29.2 (±1.1)	12.6 (±0.0)
	F	26100 (±1600)	40300 (±1900)	40.1 (±0.6)	39.3 (±0.9)	12.3 (±0.1)
PLA-400-NFC1	*C*	46900 (±900)	84300 (±280)	49.3 (±0.5)	32.3 (±2.0)	12.8 (±0.1)
	D	33800 (±1600)	58000 (±60)	45.3 (±0.7)	34.0 (±1.5)	12.8 (±0.0)
	F	25350 (±700)	39900 (±440)	44.1 (±0.2)	39.7 (±0.3)	12.5 (±0.0)
PLA-400-NFC3	*C*	49400 (±600)	86000 (±1800)	47.6 (±0.2)	32.7 (±1.3)	12.8 (±0.1)
	D	27000 (±300)	65500 (±60)	47.8 (±0.2)	36.7 (±1.7)	12.6 (±0.0)
	F	28900 (±610)	34600 (±230)	46.0 (±0.1)	37.2 (±3.2)	12.3 (±0.0)
PLA-400-NFC5	*C*	48700 (±1300)	88000 (±700)	47.5 (±1.8)	30.1 (±2.1)	12.8 (±0.1)
	D	23000 (±2000)	62400 (±20)	45.1 (±1.0)	34.3 (±0.4)	12.7 (±0.0)
	F	20600 (±430)	35900 (±360)	45.7 (±1.0)	35.6 (±1.9)	12.3 (±0.1)
PLA-1500	*C*	59900 (±2900)	92500 (±4600)	42.8 (±1.1)	25.5 (±1.3)	13.2 (±0.0)
	D	32500 (±400)	69800 (±160)	40.4 (±1.9)	31.8 (±1.0)	13.2 (±0.1)
	F	23300 (±400)	42000 (±30)	41.0 (±0.8)	32.0 (±2.4)	13.1 (±0.0)
PLA-1500-NFC1	*C*	57800 (±2800)	93500 (±4700)	47.4 (±0.5)	28.4 (±2.6)	13.4 (±0.1)
	D	29600 (±200)	65000 (±50)	44.8 (±0.4)	32.2 (±0.1)	13.1 (±0.0)
	F	20500 (±300)	34300 (±100)	40.3 (±0.6)	38.7 (±0.1)	12.8 (±0.1)
PLA-1500-NFC3	*C*	57400 (±2800)	93000 (±4600)	46.1 (±0.9)	28.3 (±0.8)	13.3 (±0.1)
	D	30800 (±300)	68700 (±120)	45.4 (±0.6)	31.5 (±2.1)	13.2 (±0.0)
	F	22300 (±30)	35000 (±190)	41.8 (±1.6)	34.9 (±0.5)	12.8 (±0.0)
PLA-1500-NFC5	*C*	51500 (±300)	93600 (±500)	47.5 (±0.7)	28.4 (±2.3)	13.4 (±0.0)
	D	31500 (±1000)	66600 (±190)	45.5 (±0.9)	29.8 (±1.6)	13.5 (±0.1)
	F	28500 (±400)	42900 (±10)	42.3 (±3.0)	31.4 (±0.3)	13.0 (±0.1)

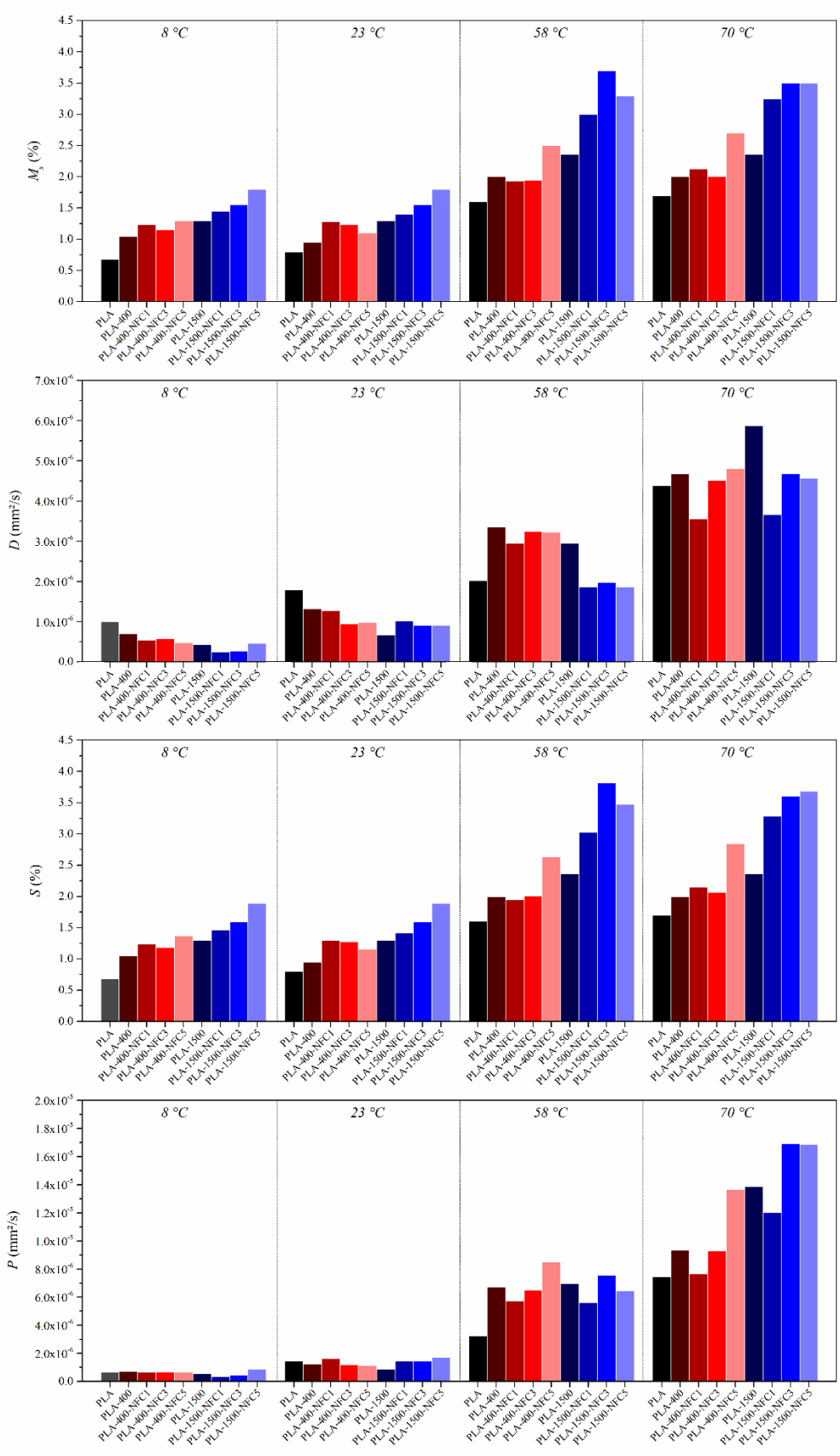

Figure S6. Diffusion coefficient (*D*), the solubility coefficient (*S*), and permeability coefficient (*P*) for the PLA, PLA/PEG and PLA/PEG/NFC nanocomposite films at 8, 23, 58, and 70 °C.