Supplementary information: Advancing the additive manufacturing of PLA-ZnO nanocomposites by fused filament fabrication

Supplementary Table 1

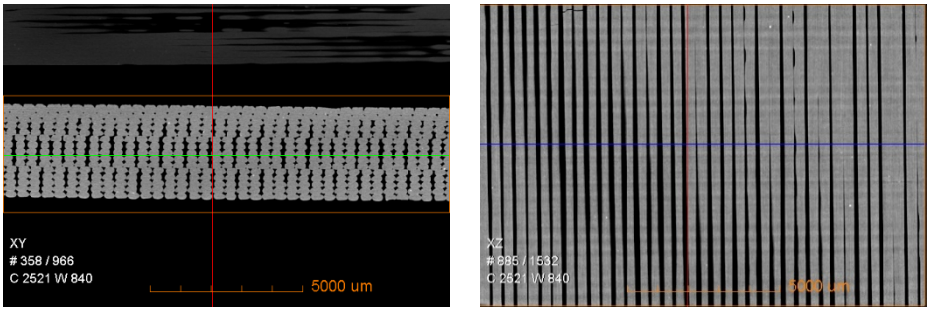
Table S1. Temperature profiles and screw speeds used for the melt extrusion of PLA and nanocomposite filaments.

Filament	Temperature profiles (°C)	Screw speed (rpm)
PLA	20, 20, 70, 150, 180, 190, 200, 210, 220, 230	200
1ST (0.5), 1S (0.5), 3ST (0.9), 3S (1.5)	20, 50, 100, 140, 150, 160, 170, 180, 185, 190	180
1MT (1.7), 3MT (3.9), 5MT (4.6), 5ST (2.5)	20, 50, 70, 90, 130, 140, 150, 170, 180, 190	150
1M (2.0), 3M (4.0), 5S (3.8), 5M (5.1)	20, 40, 60, 80, 100, 120, 130, 150, 160, 170	150

Supplementary Figure 1

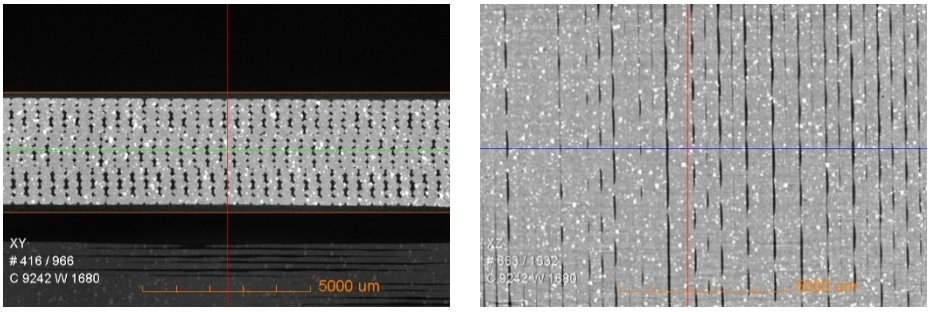
1. PLA

a. **b.**



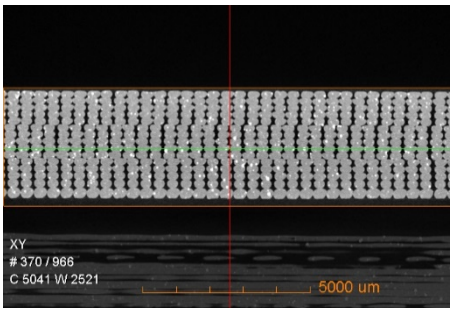
2. 1ST (0.5)

a. **b.**

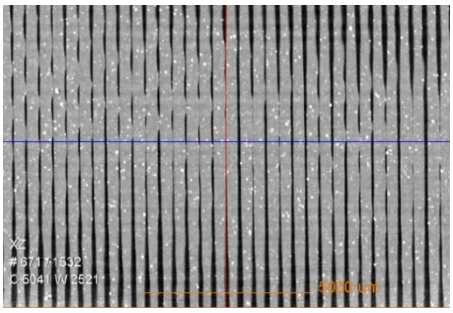


3. 1S (0.5)

a.

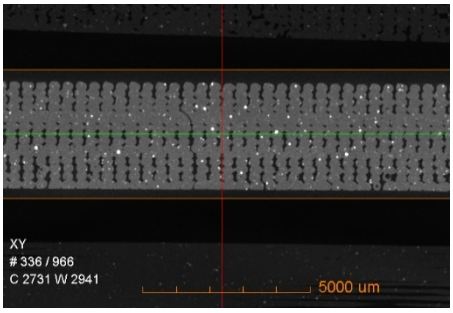


b.

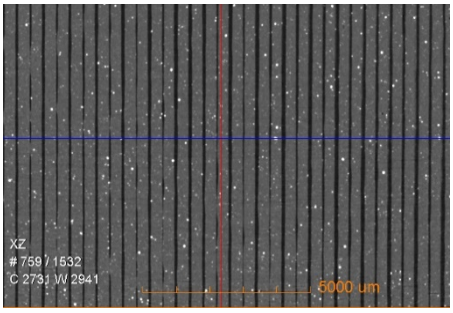


4. 1MT (1.7)

a.

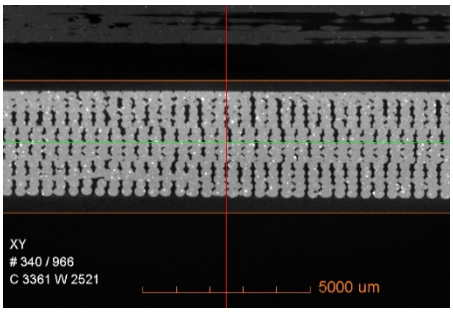


b.



5. 1M (2.0)

a.



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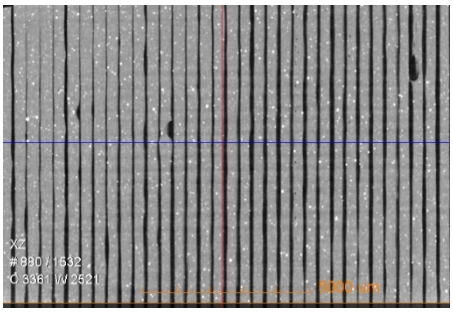
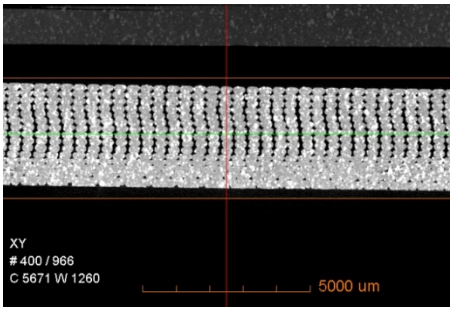


6. 3ST (0.9)

a.



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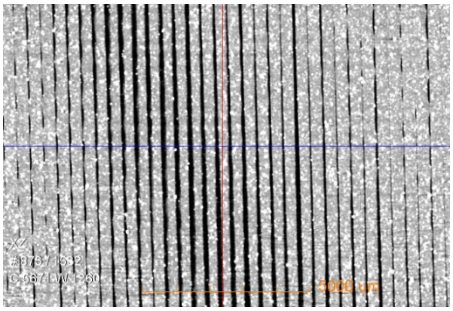
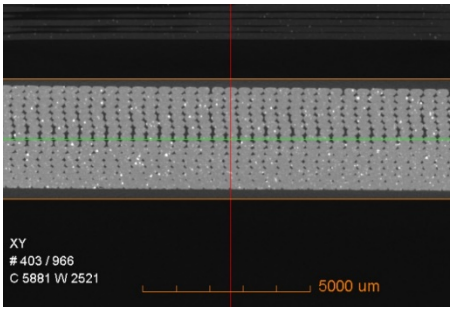
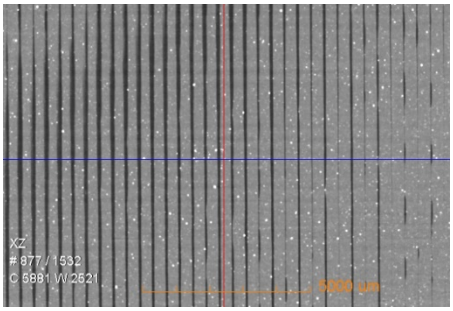


7. 3S (1.5)

a.

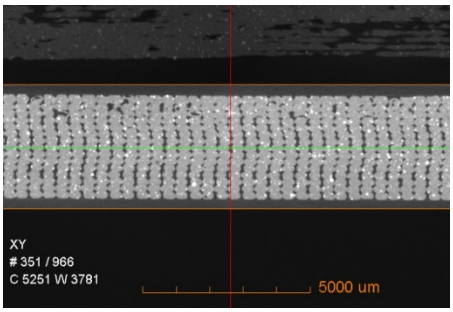


b.



8. 3MT (3.9)

a.



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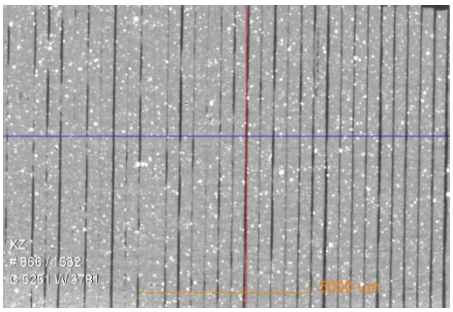
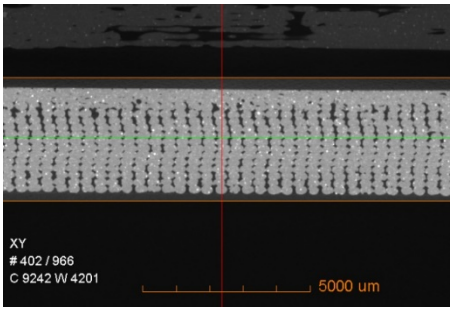


9. 3M (4.0)

a.



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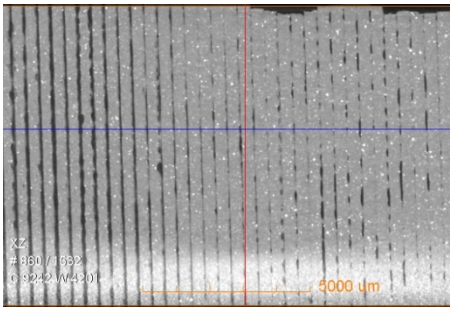
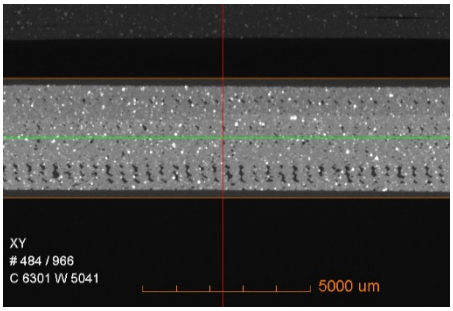
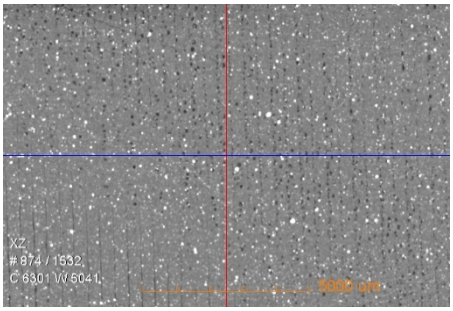


10. 5ST (2.5)

a.

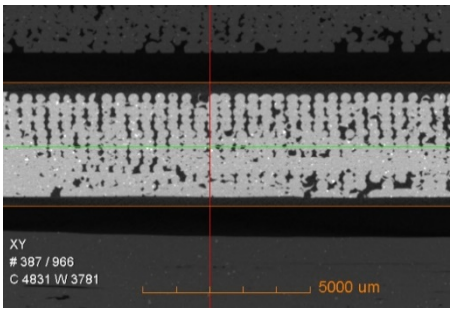


b.

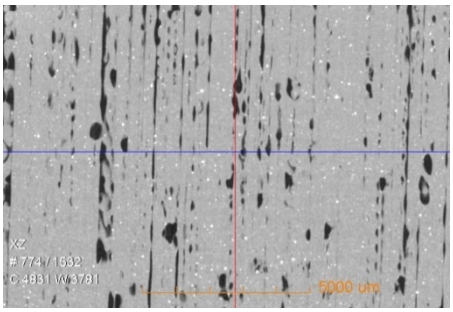


11. 5S (3.8)

a.

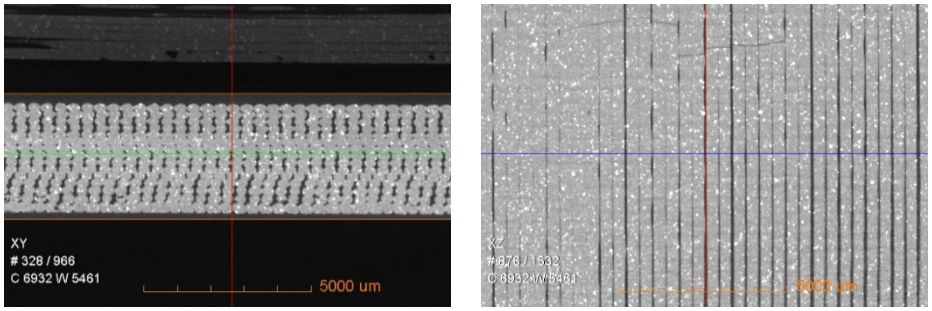


b.



12. 5MT (4.6)

a. **b.**



13. 5M (5.1)

a. **b.**

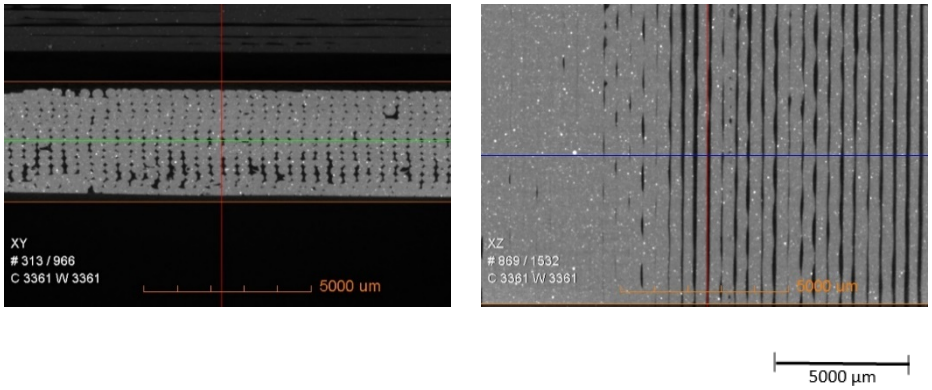


Figure S1. µCT scans of PLA and nanocomposites printed with 0° rasters: (a) X-Y plane; and (b) X-Z plane

Supplementary Figure 2

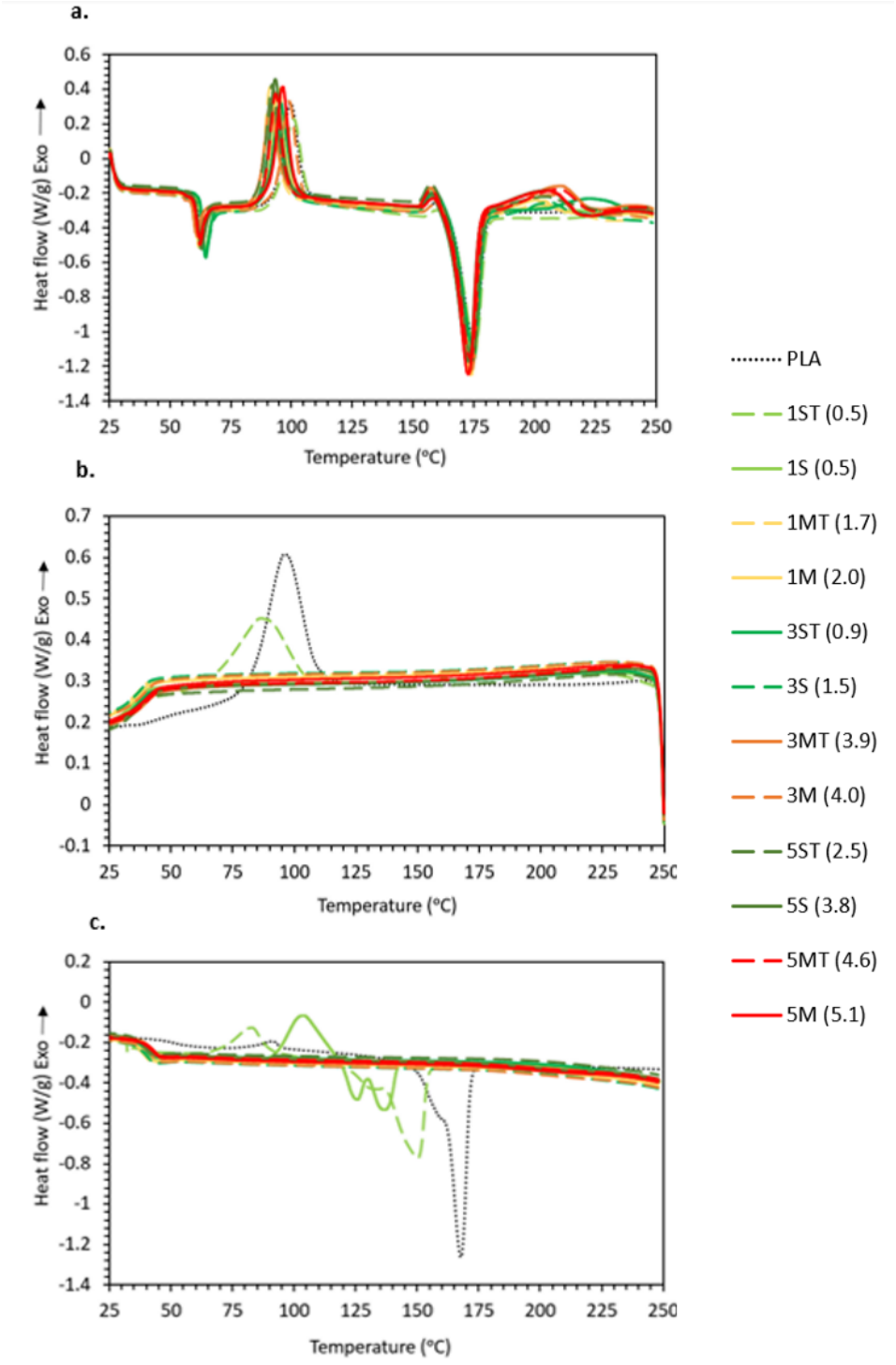


Figure S2. DSC curves of PLA and nanocomposite filaments: (a) 1st heating; (b) cooling; and (c) 2nd heating.

Supplementary Table 2

Table S2**.** Thermal properties derived from the first heating curves of DSC for PLA, 5ST (2.5), 5S (3.8), 5MT (4.6), and 5M (5.1) parts printed with 0^o rasters.

Printed parts (0^o raster)	**T_g (^{o}C)**	**T_{cc} (^{o}C)**	**ΔH_{cc} (Jg^{-1})**	**T_m (^{o}C)**	**ΔH_m (Jg^{-1})**	**X_c (%)**
PLA	60.2	98.5	20.5	176.0	42.3	23.4
5ST (2.5)	59.0	92.4	25.3	171.6	47.7	25.3
5S (3.8)	60.4	95.1	21.7	170.7	42.9	24.0
5MT (4.6)	60.2	93.1	26.2	172.1	56.0	22.6
5M (5.1)	59.9	93.0	26.0	168.3	47.3	24.1

Supplementary Table 3

Table S3. Thermal properties derived from the first heating curves of DSC for PLA, 5ST (2.5), 5S (3.8), 5MT (4.6), and 5M (5.1) parts printed with 90^o rasters.

Printed parts (90^o raster)	**T_g (^{o}C)**	**T_{cc} (^{o}C)**	**ΔH_{cc} (Jg^{-1})**	**T_m (^{o}C)**	**ΔH_m (Jg^{-1})**	**X_c (%)**
PLA	60.8	98.4	23.2	175.3	42.8	21.04
5ST (2.5)	60.0	90.1	23.1	171.2	48.8	29.1
5S (3.8)	60.2	97.2	24.1	170.2	42.0	20.3
5MT (4.6)	59.0	91.9	27.4	170.5	49.6	25.1
5M (5.1)	59.6	97.2	25.4	170.1	45.9	23.1

Supplementary Figure 3

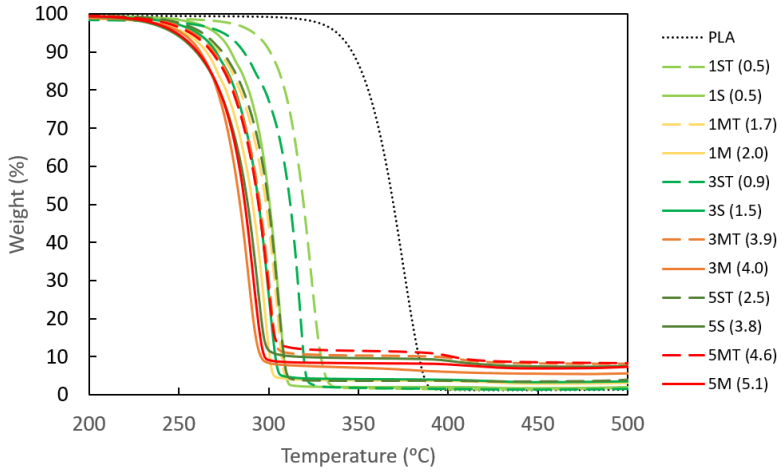


Figure S3. TGA curves of PLA and nanocomposites.

Supplementary Figure 4

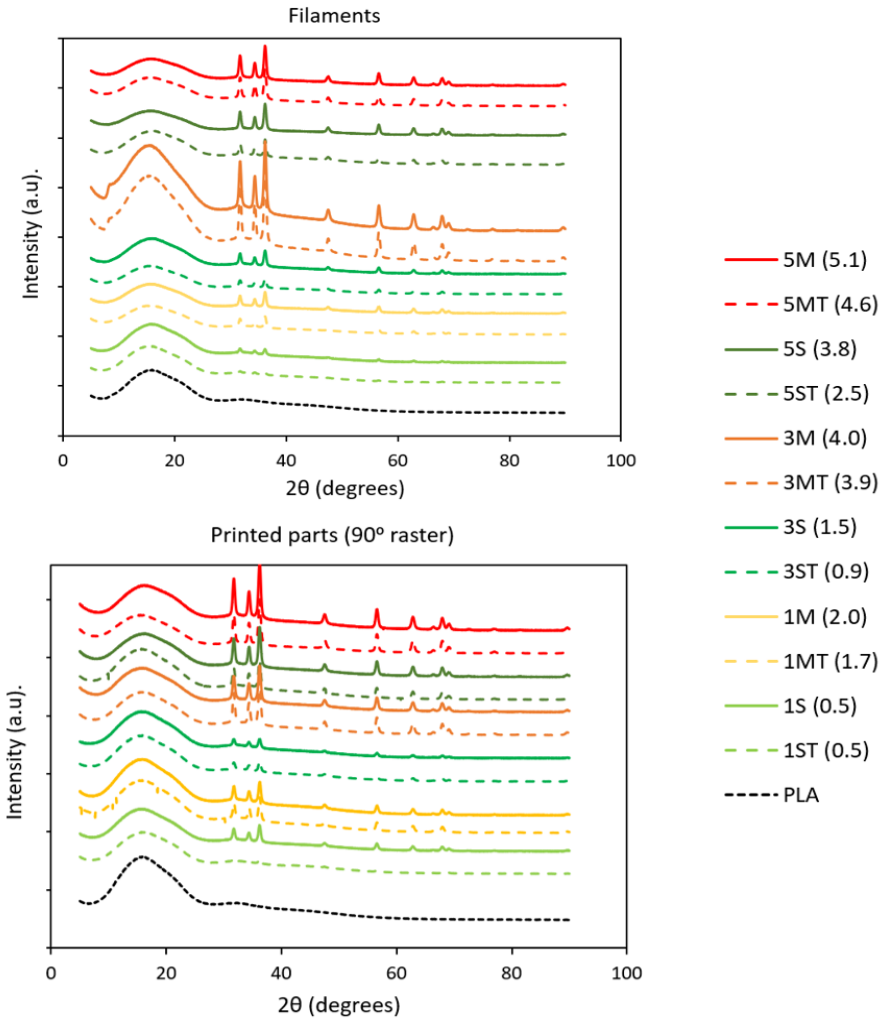


Figure S4**.** Diffractograms of PLA and nanocomposite filament

Supplementary Figure 5

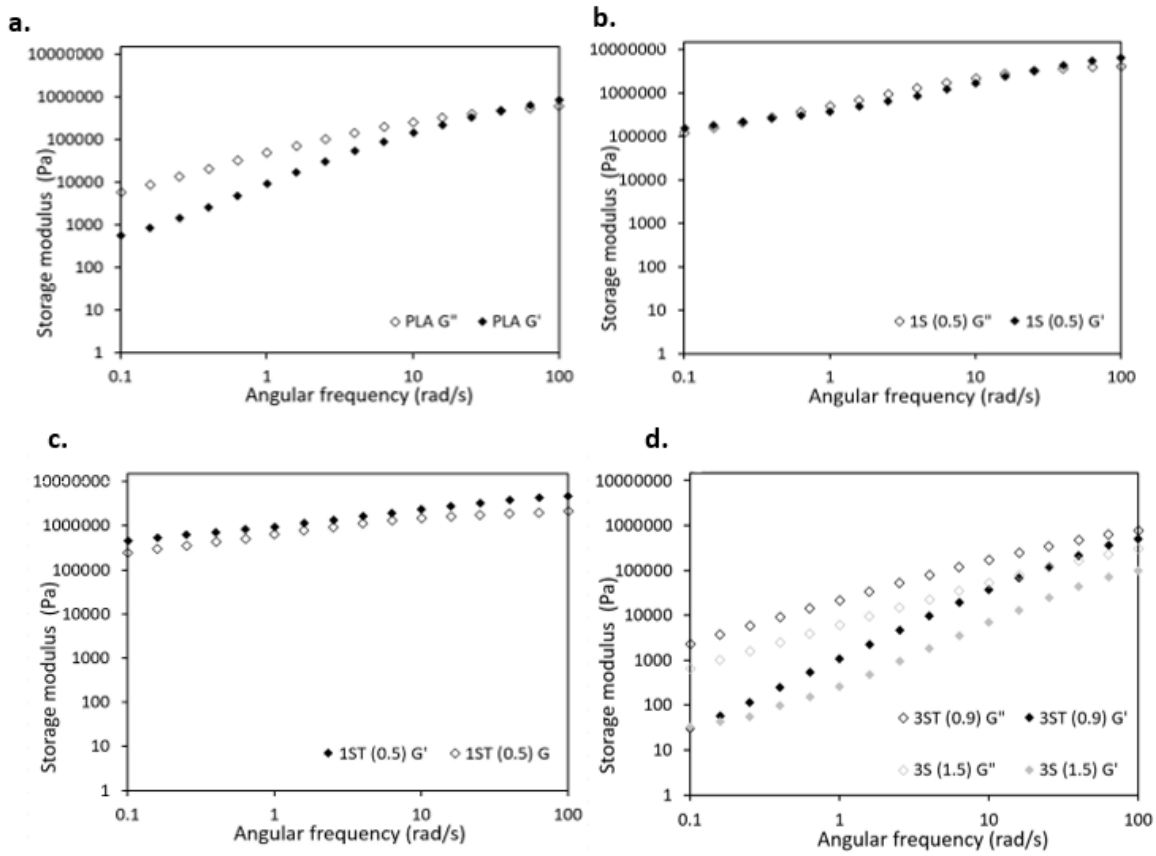


Figure S5. Storage and loss modulus curves variation: (a) PLA; (b) 1S (0.5); (c) 1ST (0.5); and (d) 3ST (0.9) and 3S (1.5) representative of the rest of the nanocomposites