# Achieving efficient and large-scale preparation of mesophase- Nylon 11 film by random copolymerization of Nylon 11 and Nylon 611

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## 1. Thermal Data for Compressed (C) and Compressed and Annealed (CA) Nylon Films

Table S1 Thermal Data for C (left) and CA (right) Nylon Films

| C samples | ΔH (J g-1) | Tm (°C) | Tg (°C) | Crystallinity (wt.%)[a] |
|---|---|---|---|---|
| PA11 | 38.15 | 183.7 | 51.12 | 15.64 |
| coPA-1 | 27.25 | 173.2 | 50.25 | 11.12 |
| coPA-2 | 27.14 | 165.4 | 47.06 | 11.03 |
| coPA-3 | 27.85 | 149.9 | 44.59 | 11.26 |
| coPA-4 | 30.05 | 146.1 | 44.23 | 12.09 |
| coPA-5 | 32.10 | 147.6 | 38.52 | 12.85 |

| CA samples | ΔH (J g-1) | Tm (°C) | Crystallinity (wt.%)[a] |
|---|---|---|---|
| PA11 | 39.88 | 183.9 | 16.34 |
| coPA-1 | 30.76 | 172.6 | 12.55 |
| coPA-2 | 29.48 | 164.8 | 11.98 |
| coPA-3 | 31.16 | 149.0 | 11.26 |
| coPA-4 | 30.21 | 145.3 | 12.15 |
| coPA-5 | 31.82 | 146.6 | 12.74 |

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## 2. Infrared spectrum and $^1$H NMR spectrum of 611 salt

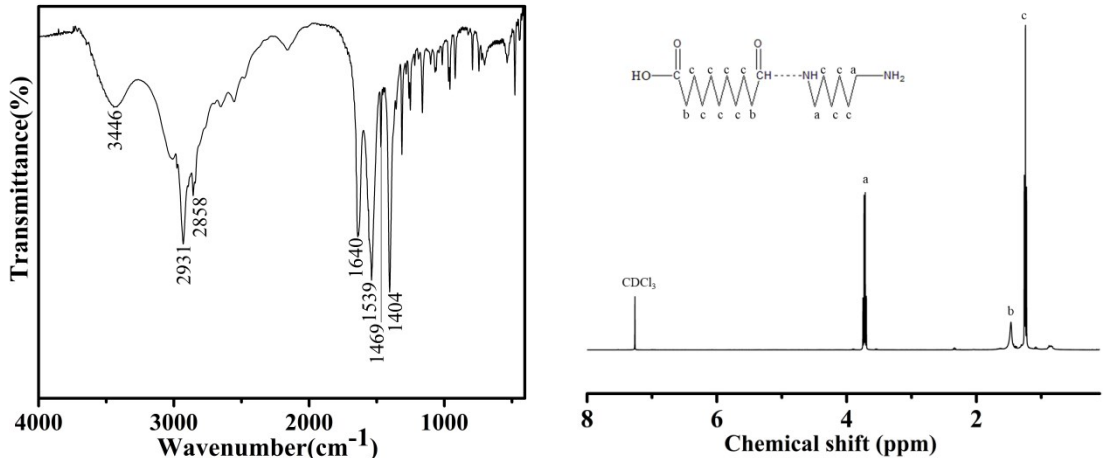


Fig. S1 Infrared spectrum (left) and $^1$H NMR spectrum (right) of 611 salt

For infrared spectrum: 3446 cm$^{-1}$ (N–H stretching), 2931 and 2858 cm$^{-1}$ (-CH2- stretching), 1640 cm-1 (the

characteristic peak of COO- and $NH_3^+$ ), 1539 $cm^{-1}$ (N-H bending), 1469 and 1404 $cm^{-1}$ (COO- stretching).

For $^1$H NMR spectrum：δ3.73(4H,H-a), δ1.43(4H,H-b), δ1.31(22H,H-c).

## 3. Thermogravimetric curves of nylon samples

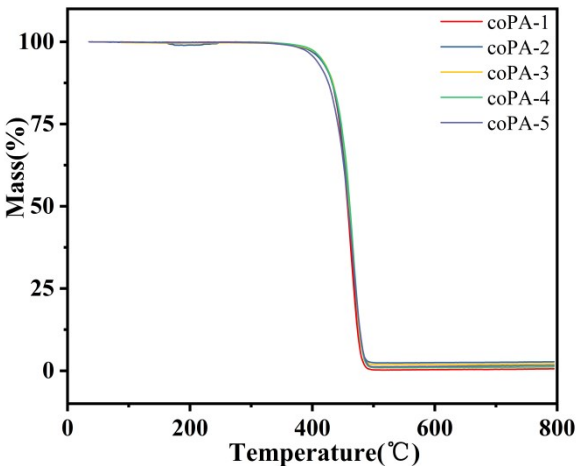


Fig. S2 Thermogravimetric curves of nylon samples

Table S2Main date Collected from TG curves

| Samples | T2% (℃) | T5% (℃) |
|---|---|---|
| coPA-1 | 390 | 414 |
| coPA-2 | 389 | 412 |
| coPA-3 | 393 | 414 |
| coPA-4 | 395 | 414 |
| coPA-5 | 381 | 404 |

All the nylon copolymers had excellent thermal stability, and the Tm of all nylon copolymers was lower than 180 °C, indicating the nylon copolymer is suitable for hot-processing.

## 4. DSC heating runs at 10 °C /min, 20 °C /min and 40 °C /min of PA11

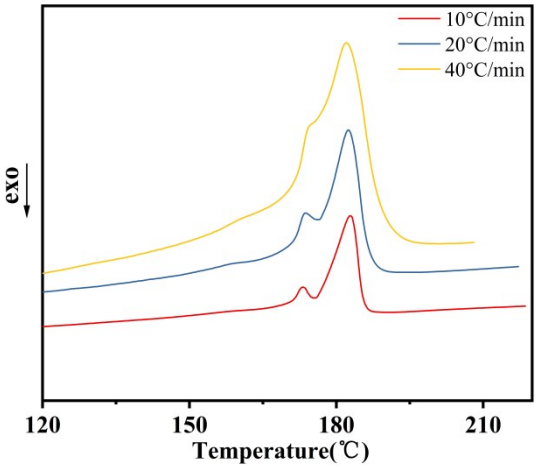


Fig. S3 DSC heating runs at 10 °C /min, 20 °C /min and 40 °C /min of PA11

5. Non-isothermal Crystallization Kinetic Analysis

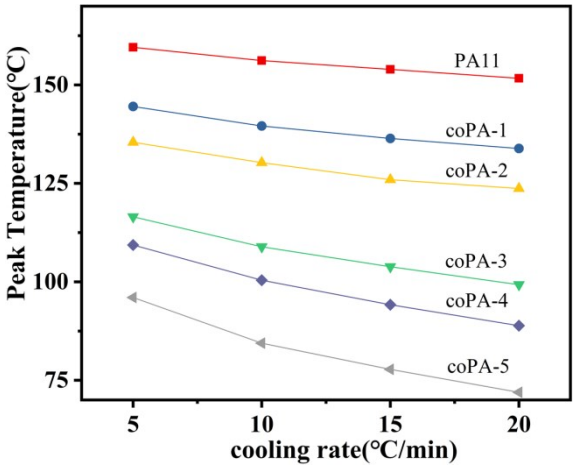


Fig. S4 the relationship of crystallization peak temperature with cooling rate for nylon samples

The crystallization peak temperature of all nylon copolymers decreased with the increase of cooling rate, it was attributed to the thermal hysteresis at the cooling process. Moreover, increasing the chemical heterogeneity, the hysteresis was more obvious.

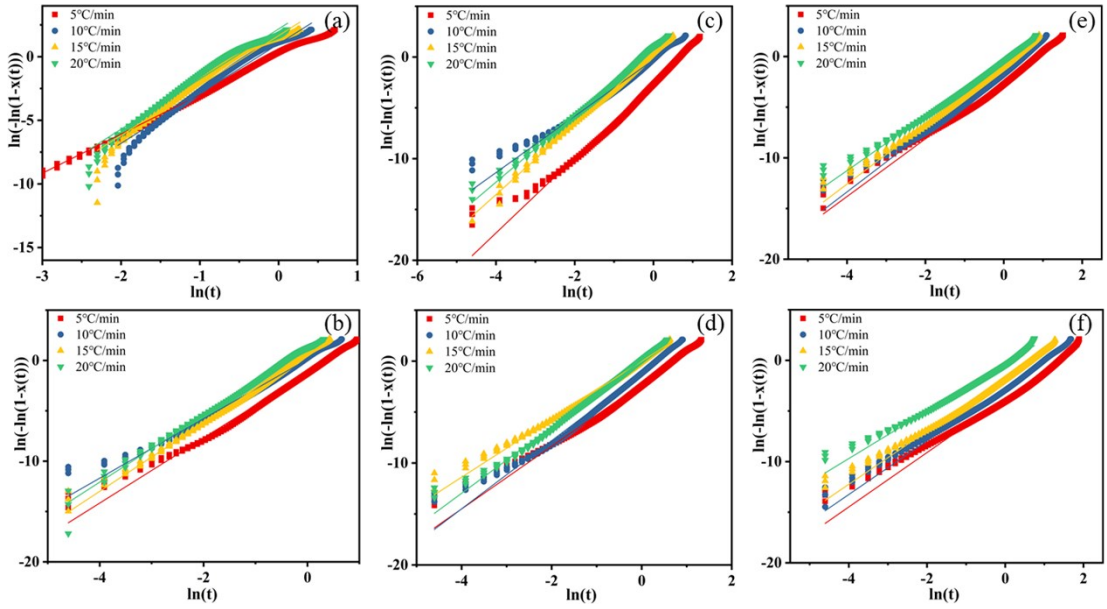


Fig. S5 The ln[-ln(1-X(t))] relating to ln(t) for nonisothermal crystallization process

Table S3 The kinetic parameters relating to non-isothermal crystallization of nylon samples

| Samples | Φ (°C/min) | n | Average of n | Zt | Zc | R2 |
|---|---|---|---|---|---|---|
| PA11 | 5 | 3.079 | 3.711 | 1.087 | 1.017 | 0.9956 |
| | 10 | 3.909 | | 2.749 | 1.106 | 0.9708 |
| | 15 | 3.917 | | 5.240 | 1.117 | 0.9673 |
| | 20 | 3.938 | | 8.864 | 1.115 | 0.9723 |
| coPA-1 | 5 | 3.237 | 3.228 | 0.299 | 0.785 | 0.9921 |
| | 10 | 2.950 | | 1.124 | 1.012 | 0.9899 |
| | 15 | 3.403 | | 1.864 | 1.042 | 0.9964 |
| | 20 | 3.323 | | 3.376 | 1.063 | 0.9952 |
| coPA-2 | 5 | 3.691 | 3.306 | 0.079 | 0.602 | 0.9899 |
| | 10 | 2.774 | | 0.766 | 0.974 | 0.9865 |
| | 15 | 3.473 | | 1.443 | 1.025 | 0.9987 |
| | 20 | 3.286 | | 2.322 | 1.043 | 0.9966 |
| coPA-3 | 5 | 3.074 | 3.130 | 0.111 | 0.644 | 0.9891 |
| | 10 | 3.344 | | 0.328 | 0.894 | 0.9901 |
| | 15 | 2.845 | | 0.990 | 0.999 | 0.9928 |
| | 20 | 3.258 | | 1.067 | 1.003 | 0.9954 |
| coPA-4 | 5 | 2.842 | 2.853 | 0.087 | 0.614 | 0.9908 |
| | 10 | 2.952 | | 0.213 | 0.857 | 0.9898 |
| | 15 | 2.919 | | 0.404 | 0.941 | 0.9941 |
| | 20 | 2.697 | | 0.628 | 0.977 | 0.9954 |
| coPA-5 | 5 | 2.687 | 2.578 | 0.024 | 0.475 | 0.9812 |
| | 10 | 2.648 | | 0.070 | 0.767 | 0.9930 |
| | 15 | 2.628 | | 0.178 | 0.891 | 0.9928 |
| | 20 | 2.349 | | 0.741 | 0.985 | 0.9870 |