

## Electronic Supplementary Information (ESI)

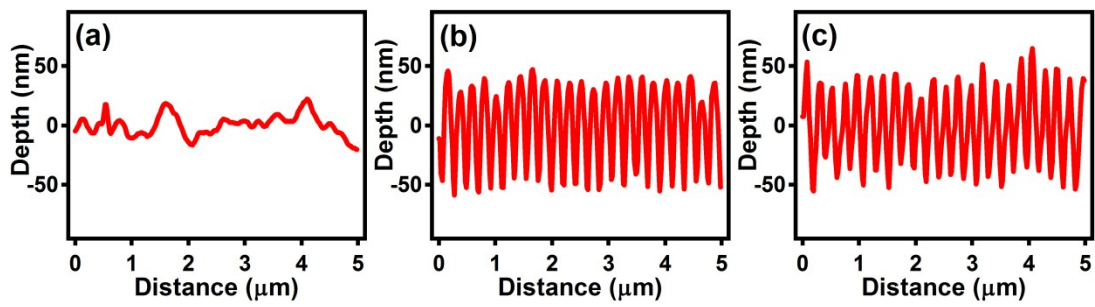
### **Nanoimprinting-induced molecular orientation in poly(3-hexylthiophene) nanogratings and its miraculous eternal after thermal annealing**

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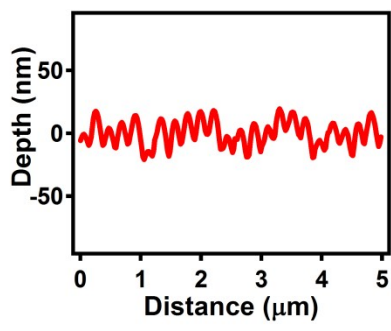
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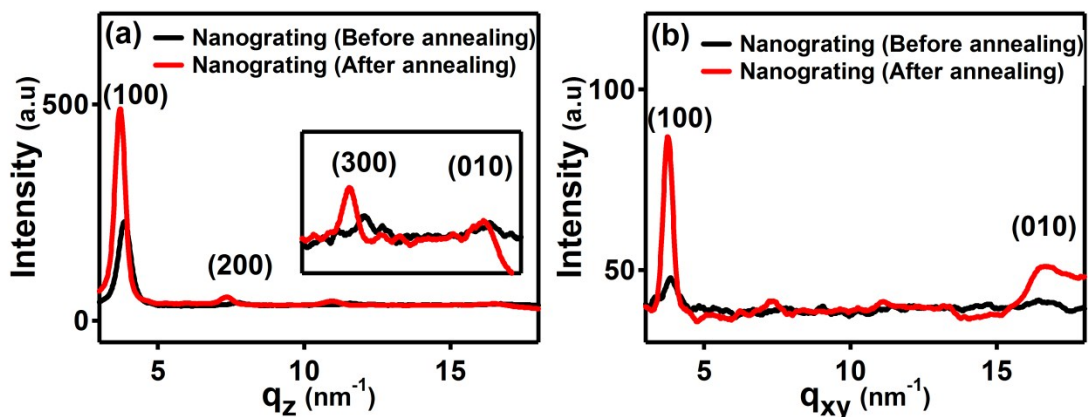
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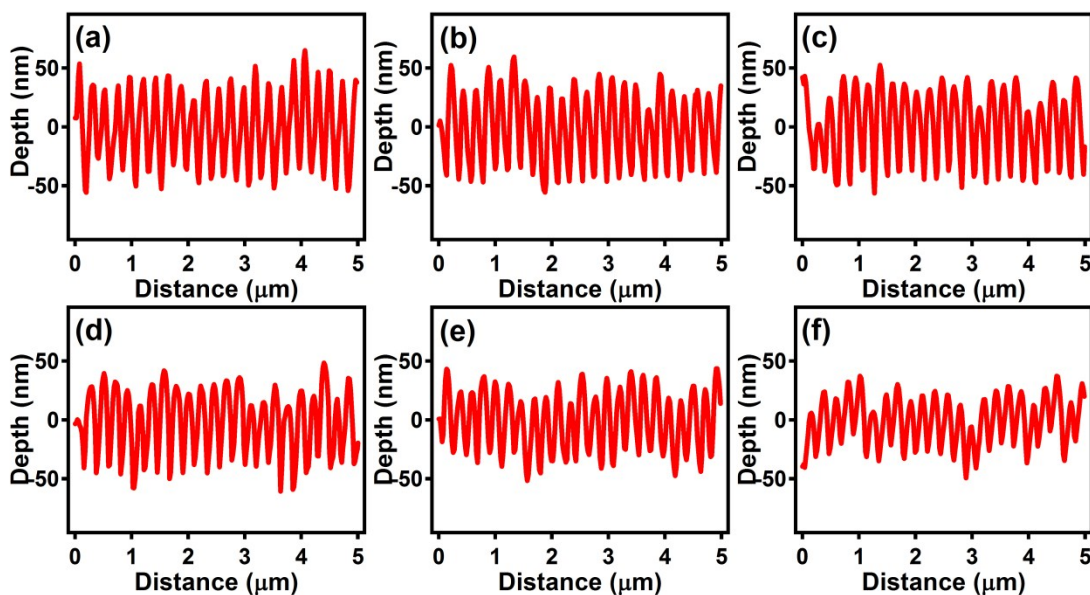
**Fig. S1.** AFM cross-sectional height images of unpatterned P3HT film (a), silicon mold (b), and patterned P3HT nanograting film (c). The source of data is collected from the corresponding red lines of height images within Fig. 2.



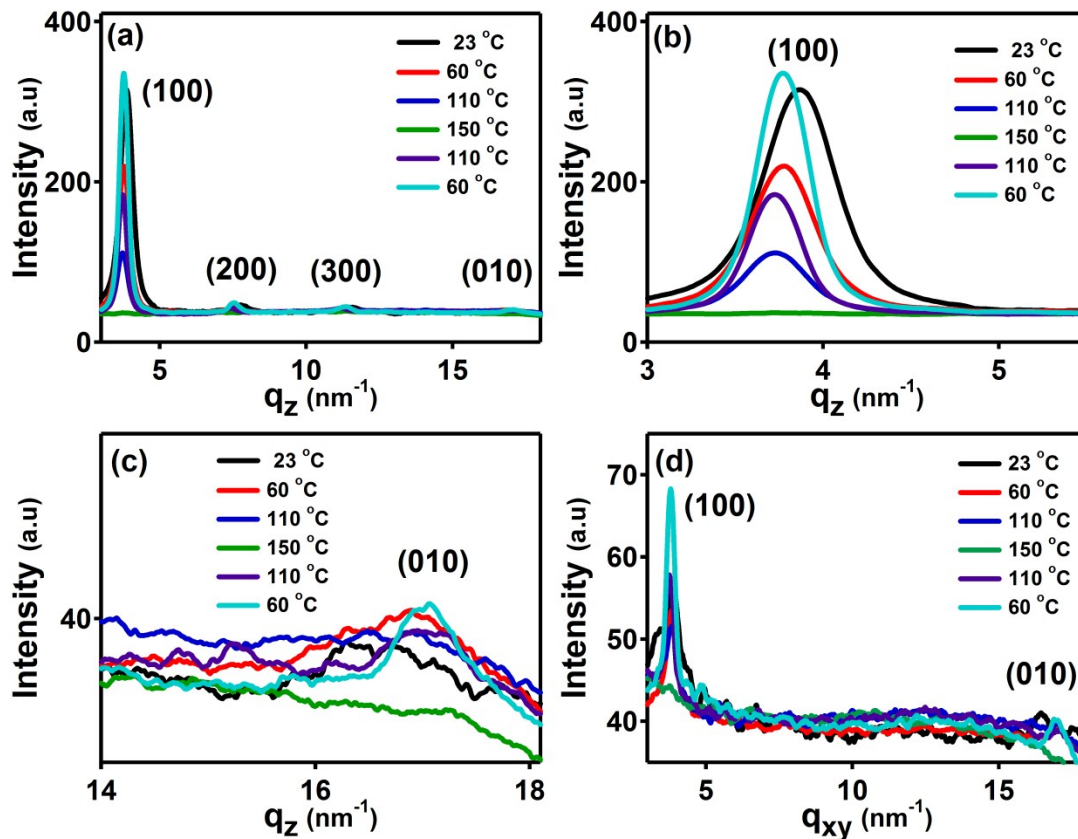
**Fig. S2.** AFM cross-sectional height image of nanograting P3HT film after thermal annealing. The thermal annealing is performed under a fixed temperature (150 °C) for 4h and then the patterned film is cooled down to room temperature (23 °C). The source of data is collected from the corresponding red line of height image within Fig. 4a.



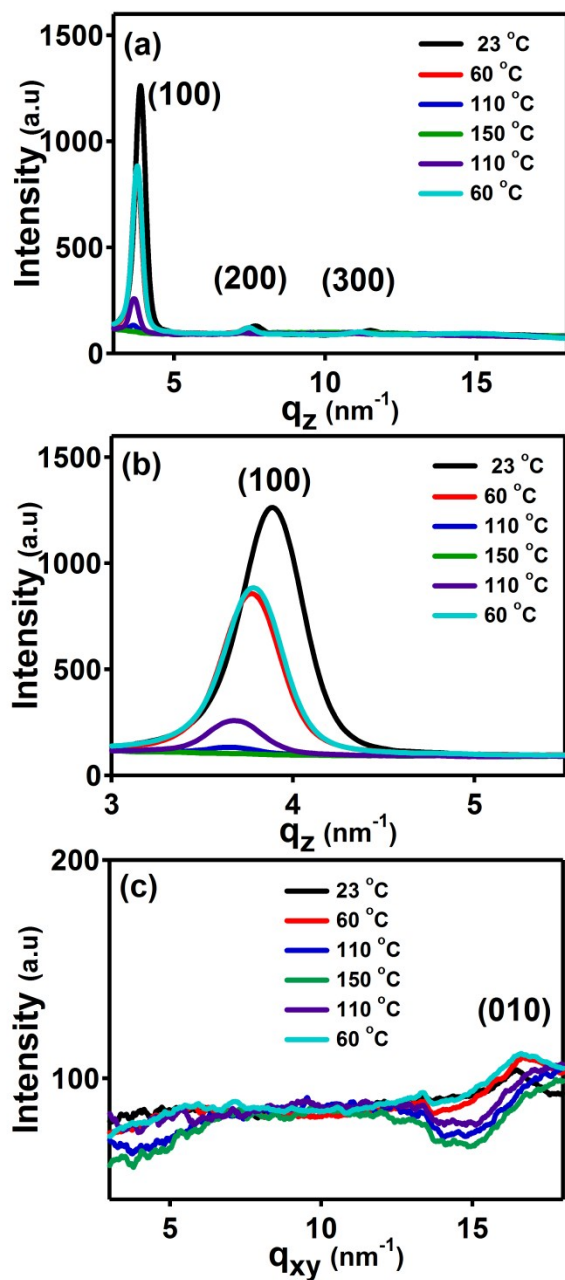
**Fig. S3.** The 1D GIWAXD intensity profiles of nanograting P3HT film before and after thermal annealing integrated along the  $q_z$  direction (a) and along the  $q_{xy}$  direction (b). The thermal annealing is performed under a fixed temperature (150 °C) for 4h and then the patterned film is cooled down to room temperature (23 °C). The integrated data is collected from the corresponding 2D images as shown in Fig. 3c and 4b.



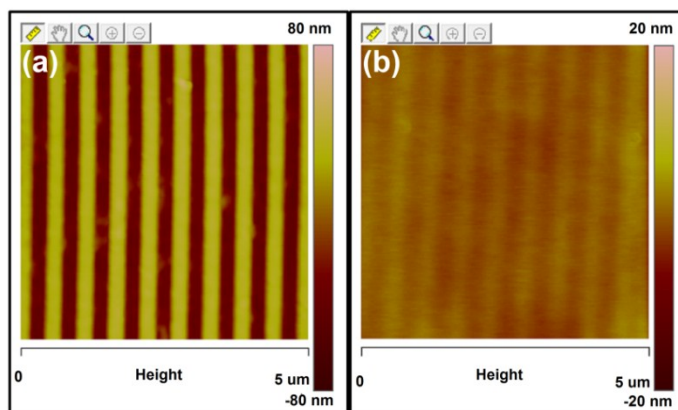
**Fig. S4.** AFM cross-sectional height images of nanograting P3HT film under the thermal annealing treatment in situ for various temperature: (a) 23 °C, (b) 60 °C, (c) 110 °C, (d) 150 °C, (e) 110 °C, (f) 60 °C. The data is collected from the corresponding red lines of height images shown in Fig. 5.



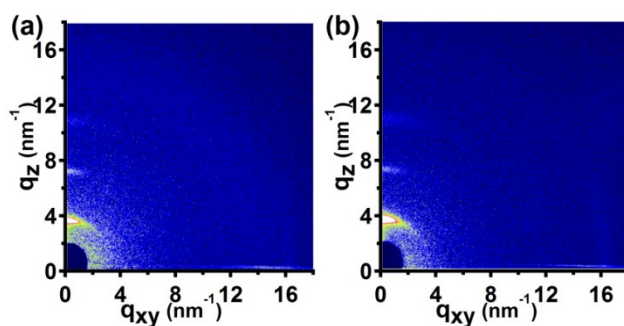
**Fig. S5.** The 1D GIWAXD intensity profiles of nanograting P3HT film performed by annealing in situ integrated along the  $q_z$  direction (a-c) and along the  $q_{xy}$  direction (d). The result is collected under the elevated temperature from 23 to 150 °C continually and every measured temperature is held for 5 min to retain the heating uniformity of polymer film. The integrated data is obtained from the 2D patterns shown in Fig. 6. The integrated figures (b) and (c) show magnified views of the (100) and (010) peaks along the  $q_z$  direction.



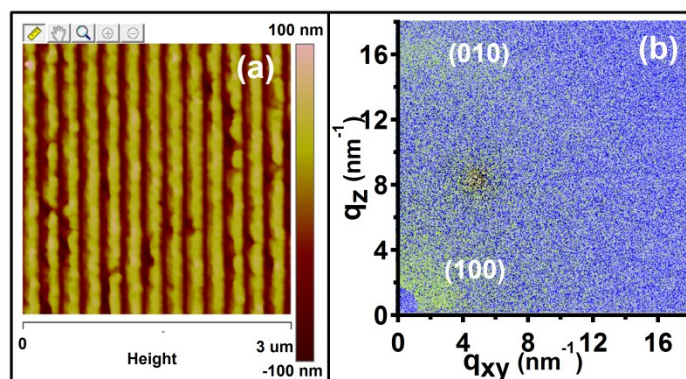
**Fig. S6.** The 1D GIWAXD intensity images of unpatterned P3HT film integrated along the  $q_z$  direction (a-b) and along the  $q_{xy}$  direction (c) under thermal annealing in situ. The thermal annealing is performed at the elevated temperature from 23 to 150 °C continually and every taken temperature is retained for 5 min to keep the film heating uniformity. The integrated data is obtained from the 2D patterns shown in Fig. 7. The obtained figure (b) indicates magnified view of the (100) peak along the  $q_z$  direction.



**Fig. S7.** AFM height images of patterned P3HT film before (a) and after annealing treatment (b), patterned P3HT nanograting film bearing  $\sim 260$  nm line width and  $\sim 540$  nm period. The sample is annealed from 23 to 150 °C in air to hold some time and then cooled down to 23 °C.



**Fig. S8.** 2D GIWAXD images of nanograting P3HT film before (a) and after annealing treatment (b), patterned P3HT nanograting film bearing  $\sim 260$  nm line width and  $\sim 540$  nm period. The sample is annealed from 23 to 150 °C in air to hold some time and then cooled down to 23 °C.



**Fig. S9.** AFM height image (a) and 2D GIWAXD image (b) of nanograting PTB7 film.

**Table S1.** The detailed summary of diffraction position for the (100) and (010) peaks during thermal annealing.

<i>Type</i>	<i>Direction</i>	<i>Temperature [°C]</i>	<i>Peak (100)</i>	<i>Peak (010)</i>
<i>Nanograting film</i>	$q_{xy}$	23	3.86	16.55
		60	3.83	16.90
		100	3.82	16.99
		140	/	/
		100	3.75	17.05
		60	3.80	16.92
	$q_z$	23	3.86	16.54
		60	3.78	16.90
		100	3.73	16.95
		140	/	/
		100	3.73	17.02
		60	3.78	17.02
<i>Unpatterned film</i>	$q_{xy}$	23	/	16.47
		60	/	16.78
		100	/	/
		140	/	/
		100	/	/
		60	/	16.65
	$q_z$	23	3.88	/
		60	3.77	/
		100	3.65	/
		140	/	/
		100	3.68	/
		60	3.79	/