

Supporting Information

Polyamide Nanofiltration Membranes Incorporated with Cellulose Nanocrystals for Enhanced Water Flux and Chlorine Resistance

*Sheng Huang^a, Ming-Bang Wu^b, Cheng-Ye Zhu^b, Meng-Qi Ma^b, Jing Yang^b, Jian Wu^{*a}, Zhi-Kang Xu^{*b}*

^aDepartment of Chemistry, Zhejiang University, Hangzhou 310027, China

^bMOE Key Laboratory of Macromolecular Synthesis and Functionalization, and Key Laboratory of Adsorption and Separation Materials & Technologies of Zhejiang Province, Department of Polymer Science and Engineering, Zhejiang University, Hangzhou 310027, China

*Corresponding authors

E-mail addresses: jianwu@zju.edu.cn (Jian Wu), xuzk@zju.edu.cn (Zhi-Kang Xu)

Address (all the authors): Zheda Road NO. 38, Hangzhou 310027, China.

Table of contents

Figure S1. The chemical structure of CNCs. (page S3)

Figure S2. Photograph of CNCs suspension and its AFM image. (page S3)

Figure S3. FT-IR/ATR spectra of PSf substrate, TFC and TFN-50 NFMs. (page S4)

Table S1. XPS data of the PSf substrate and nanofiltration membranes. (page S4)

Figure S4. C1s spectrum of NFMs. (page S5)

Figure S5. 3D AFM images of a) TFC, b) TFN-6, c) TFN-12, d) TFN-25, e) TFN-50, f) TFN-100 NFMs with a scan size of $5\ \mu\text{m} \times 5\ \mu\text{m}$. (page S6)

Table S2. Roughness of TFC and TFN NFMs. (page S7)

Figure. S6 Normalized water flux and salt rejection of the TFN-50 NFM after soaking in alcohol and n-hexane for 24 h. (page S7)

Figure S7. SEM images of TFC A) to D) and TFN-50 NFMs a) to d) after chlorination for different time (1-4 h). (page S8)

Figure S8. a) Dynamic contact angles of the TFC NFMs chlorinated for different time (1-4 h); b) Dynamic contact angles of the TFN-50 NFMs chlorinated for different time (1-4 h). (page S8)

Table S3. XPS data of the TFC and TFN NFMs after chlorination for 4 h. (page S8)

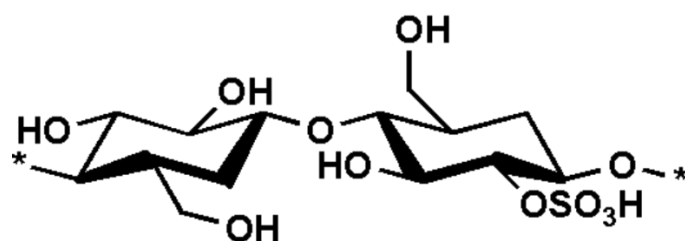


Figure S1. Chemical structure of CNCs.

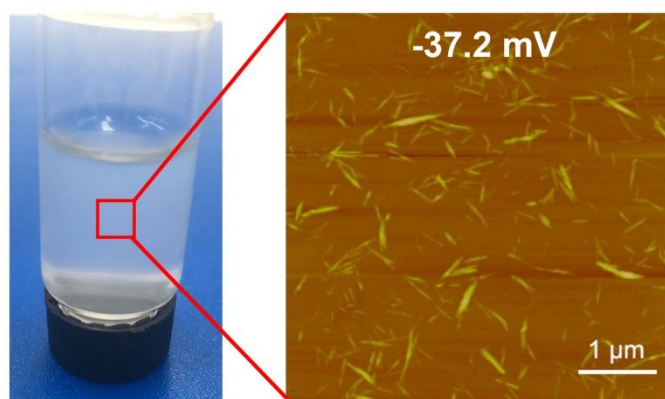


Figure S2. Photograph of CNCs suspension and its AFM image.

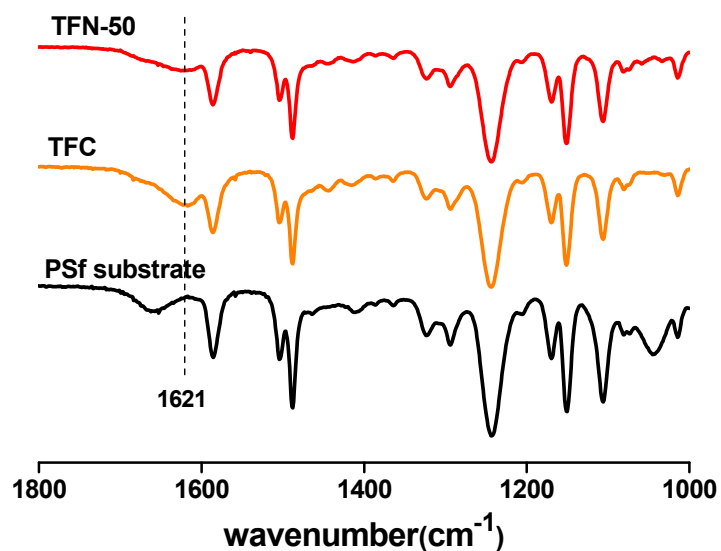


Figure S3. FT-IR/ATR spectra of polysulfone substrate, TFC NFMs and TFN-50 NFMs.

Table S1. XPS data of the polysulfone substrate and nanofiltration membranes

Sample	C1s content (%)	O1s content (%)	N1s content (%)	S2p content (%)
Polysulfone	77.41	17.44	3.88	1.28
TFC NFMs	70.20	18.25	11.31	0.24
TFN-6 NFMs	68.94	19.52	11.44	0.10
TFN-12 NFMs	69.19	18.82	11.88	0.11
TFN-25 NFMs	70.25	17.99	11.66	0.11
TFN-50 NFMs	68.79	19.39	11.63	0.19
TFN-100 NFMs	70.00	19.11	10.19	0.70

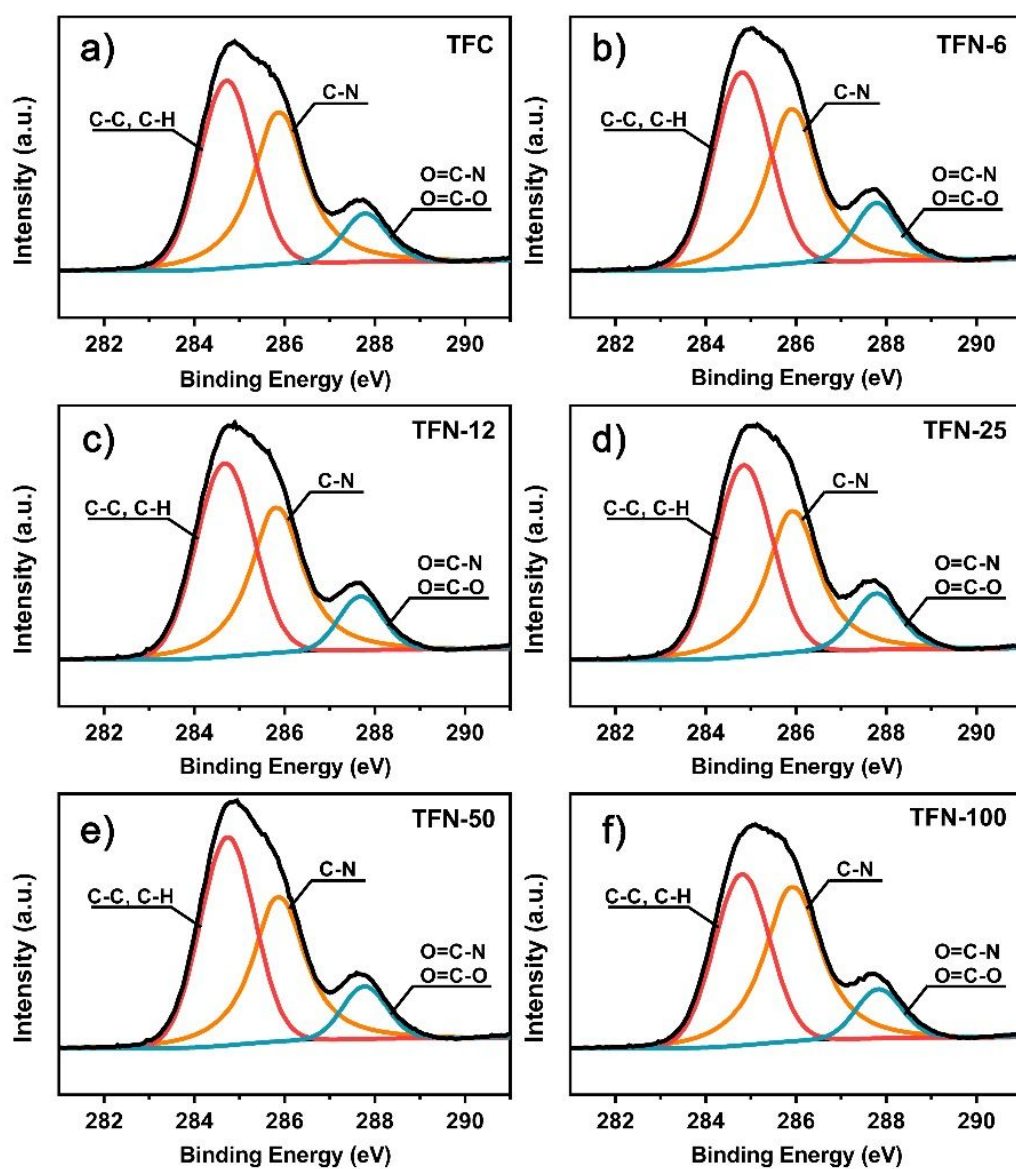


Figure S4. C1s spectra of our TFC NFMs and TFN NFMs.

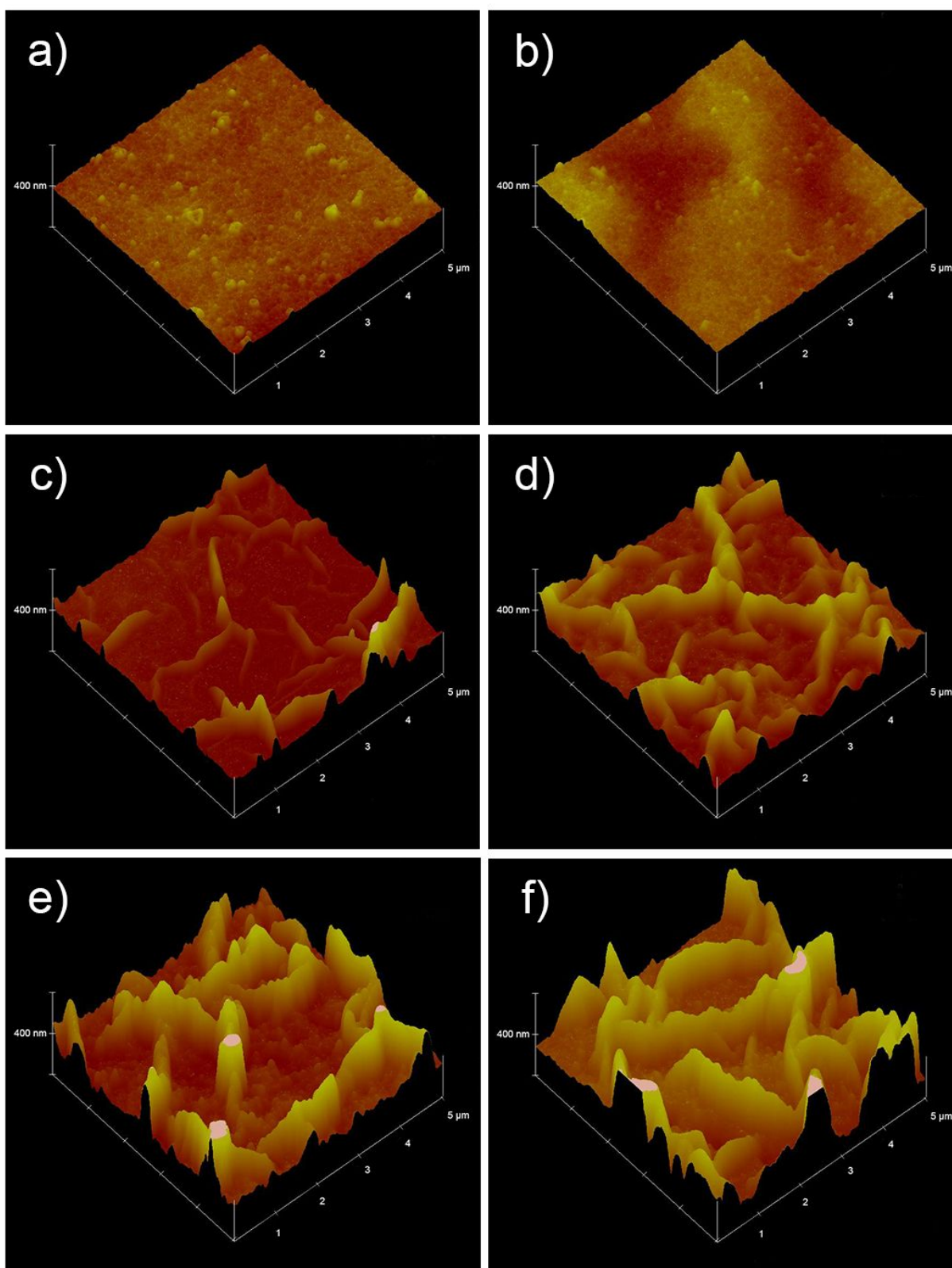
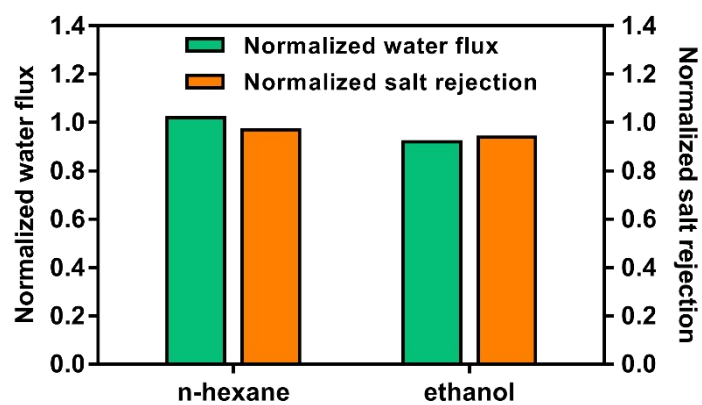


Figure S5. 3D AFM images of a) TFC, b) TFN-6, c) TFN-12, d) TFN-25, e) TFN-50, f) TFN-100 NFMs with a scan size of $5\ \mu\text{m} \times 5\ \mu\text{m}$.

Table S2. Roughness of TFC NFMs and TFN NFMs

Sample	R_a (nm)	R_{rms} (nm)
TFC	9.73 ± 2.33	12.95 ± 2.55
TFN-6	13.34 ± 7.25	17.12 ± 7.49
TFN-12	33.84 ± 8.43	49.54 ± 12.48
TFN-25	64.20 ± 3.65	77.64 ± 4.83
TFN-50	115.68 ± 25.90	144.74 ± 27.15
TFN-100	114.47 ± 14.41	138.04 ± 17.11

**Figure. S6** Normalized water flux and salt rejection of the TFN-50 NFMs after soaking in alcohol and n-hexane for 24 h.

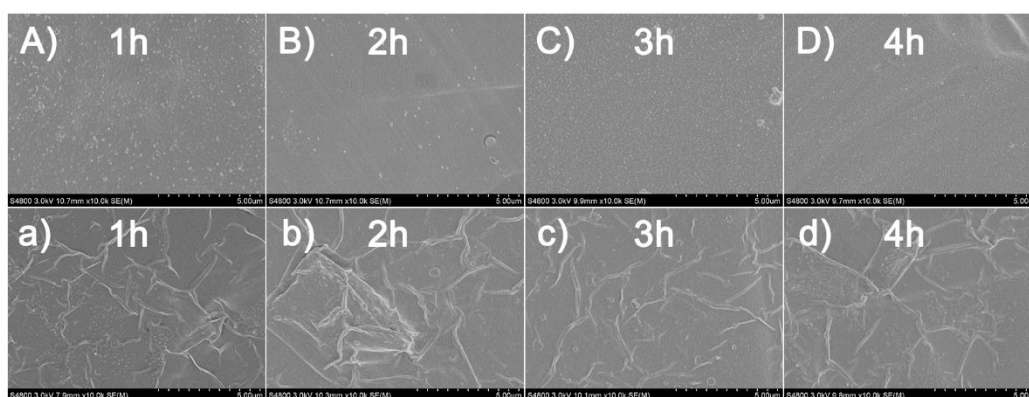


Figure S7. SEM images of TFC NFMs A) to D) and TFN-50 NFMs a) to d) after chlorination for different time (1-4 h).

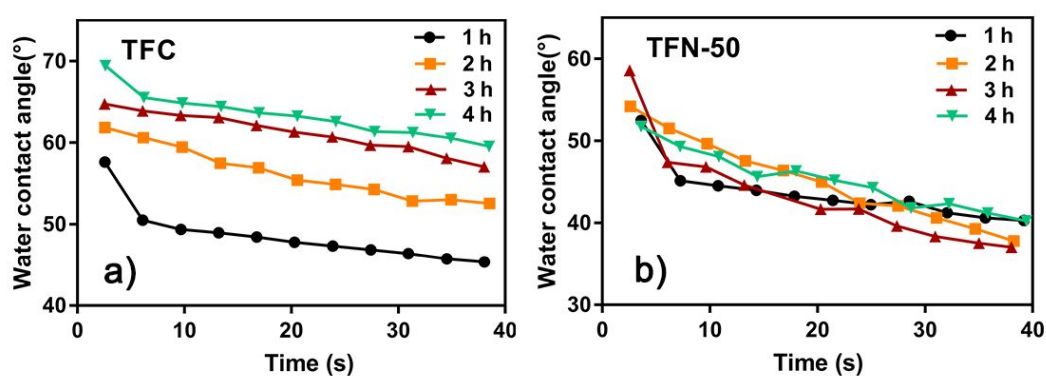


Figure S8. a) Dynamic contact angles of the TFC NFMs chlorinated for different time (1-4 h); b) Dynamic contact angles of the TFN-50 NFMs chlorinated for different time (1-4 h).

Table S3. XPS data of the TFC NFMs and TFN NFMs after chlorination for 4 h.

Sample	C1s content (%)	O1s content (%)	N1s content (%)	S2p content (%)	Cl2p content (%)
TFC	68.18	18.95	11.52	0.15	1.21
TFN-50	65.64	20.31	12.46	0.17	1.42