Supplementary Information

Atomic Oxygen Resistance of Polyimide Fibers with Phosphorus-Containing Side Chains

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Table S1. Mass loss of PI fibers versus AO exposure with difference fluence.

No.	Diamine Ratio (m/n)	SEM Images No.	Mass loss[a] 8.3×10^{19} atoms/cm^2 (mg/cm^2)	Mass loss 1.4×10^{20} atoms/cm^2 (mg/cm^2)	Mass loss 2.0×10^{20} atoms/cm^2 (mg/cm^2)	Mass loss 2.6×10^{20} atoms/cm^2 (mg/cm^2)	Mass loss 3.4×10^{20} atoms/cm^2 (mg/cm^2)	Mass loss 5.0×10^{20} atoms/cm^2 (mg/cm^2)
Kapton	--		0.35	0.60	0.85	1.15	1.45	2.10
PI-0	0/10	0-a ~ 0-e	0.35	0.55	0.80	1.00	1.20	1.80
PI-2	2/8	2-a ~ 2-e	0.35	0.45	0.60	0.90	1.15	1.40
PI-4	4/6	4-a ~ 4-e	0.35	0.45	0.60	0.70	0.80	1.05
PI-6	6/4	6-a ~ 6-e	0.25	0.30	0.35	0.50	0.60	0.75

[a] Using formula (1) to calculate the total AO fluence with Kapton® film.

Table S2. Retention of tensile strength and Yong's modulus of the fibers after AO exposed at 5.0×10^{20} atoms/cm^2.

Item	Retention of tensile strength (%)	Retention of Yong's modulus (%)
PI-0	47.78	59.15
PI-2	49.91	65.31
PI-4	51.36	51.06
PI-6	64.87	66.04

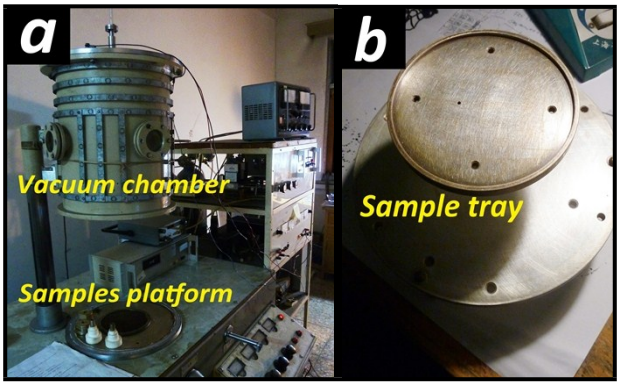

Figure S1. Ground-based AO effects simulation facility. (a) Vacuum chamber, (b) Sample tray.

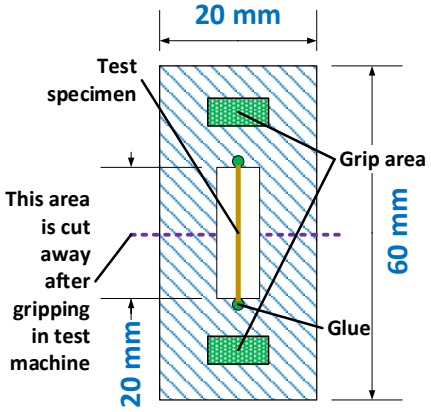

Figure S2. The schematic diagram of tensile testing for PI fiber.

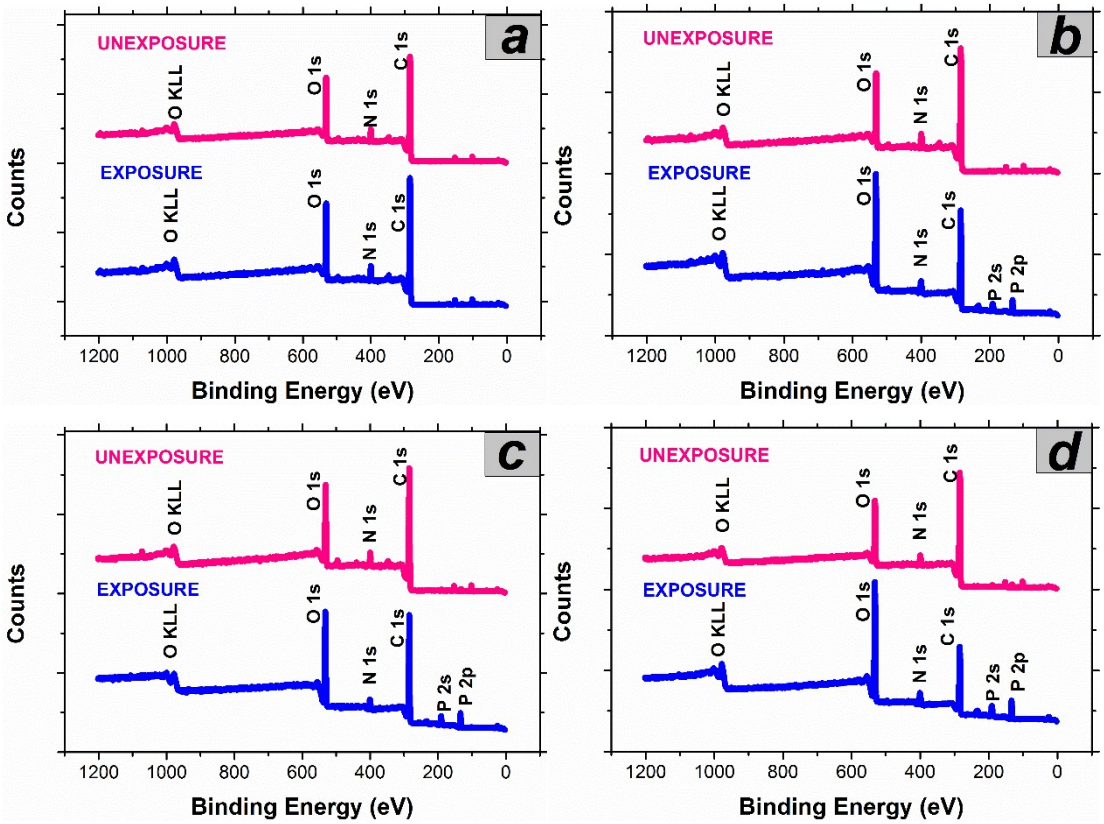

Figure S3. XPS survey spectra of fibers with and without AO exposure [a] PI-0, [b] PI-2, [c] PI-4, [d] PI-6.

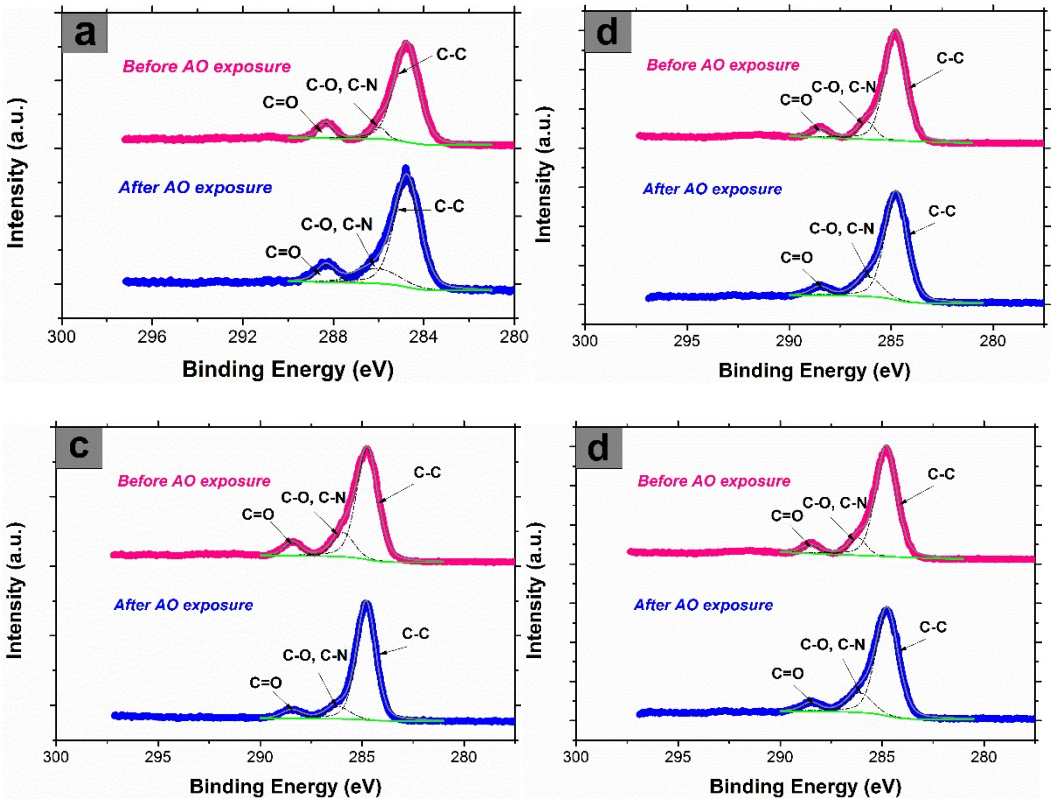

Figure S4. High resolution XPS C 1s spectra of PI fibers before and after exposed to AO [a] PI-0, [b] PI-2, [c] PI-4, [d] PI-6.

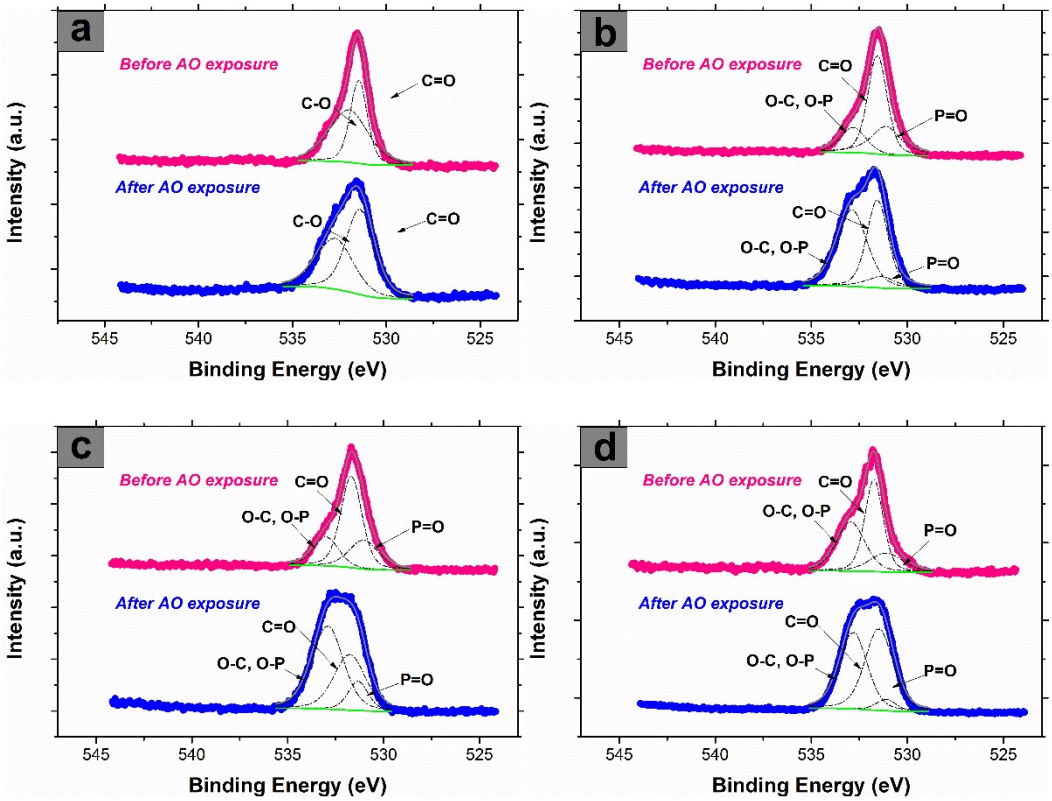

Figure S5. High resolution XPS O 1s spectra of PI fibers before and after exposed to AO [a] PI-0, [b] PI-2, [c] PI-4, [d] PI-6.

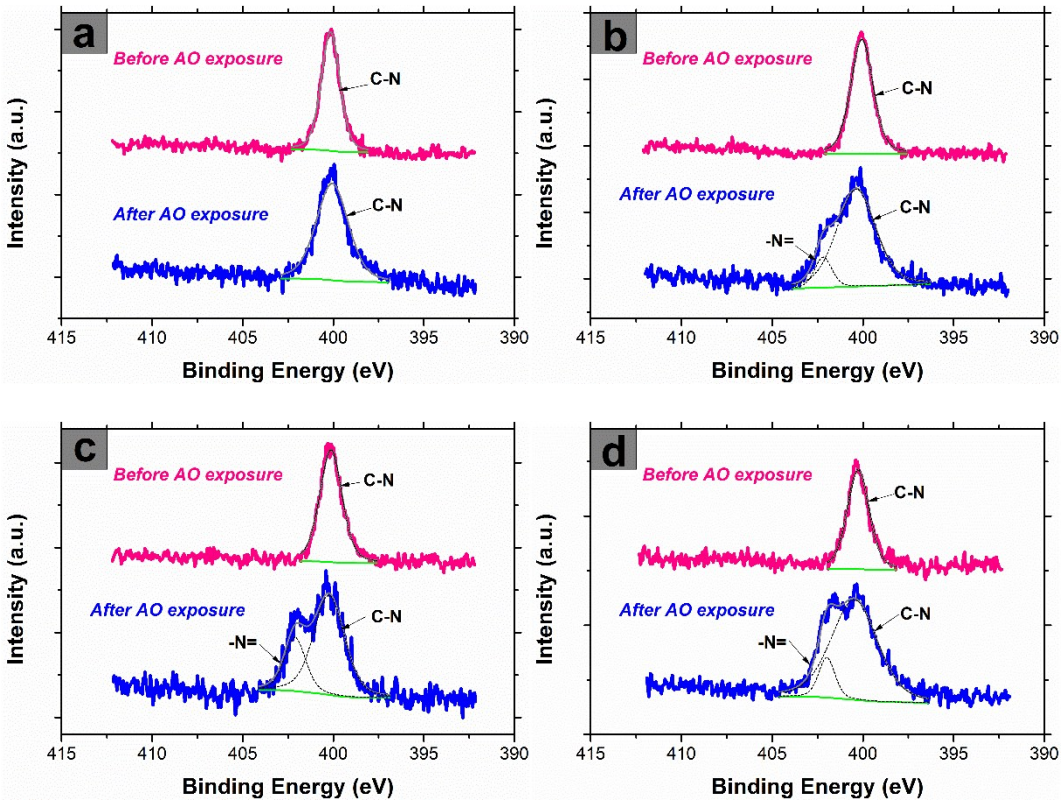

Figure S6. High resolution XPS N 1s spectra of PI fibers before and after exposed to AO [a] PI-0, [b] PI-2, [c] PI-4, [d] PI-6.

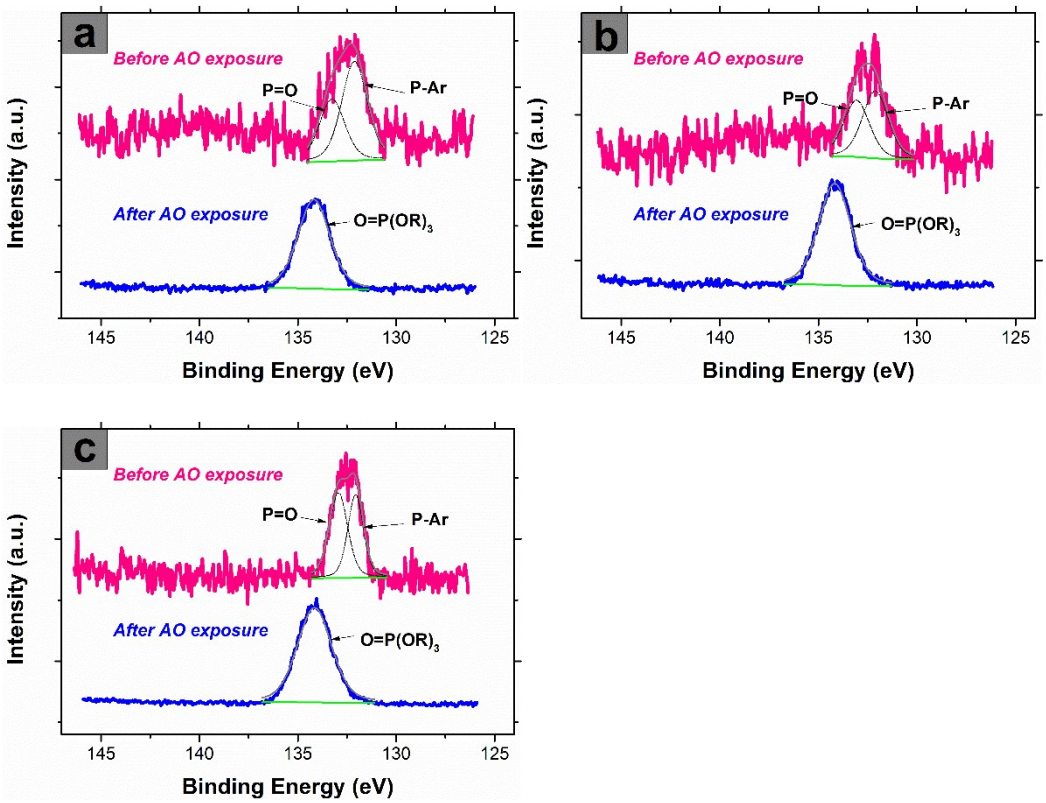

Figure S7. High resolution XPS P 2p spectra of PI fibers before and after exposed to AO [a] PI-2, [b] PI-4, [c] PI-6.