A Novel Type of One-Dimensional Organic Selenium-Containing Fibers with Superior Performance for Lithium-Selenium and **Sodium-Selenium Batteries**

Hongqiang Wang,^a Sha Li,^a Zhixin Chen,^a Hua Kun Liu^a and Zaiping Guo^{*a,b,c}

^A Institute for Superconducting & Electronic Materials, University of Wollongong, Wollongong, Australia. E-mail: <u>zguo@uow.edu.au</u> ^b Hubei Collaborative Innovation Center for Advanced Organic Chemical Materials, College of Chemistry and Chemical

Engineering, Hubei University, Wuhan, China.

^c School of Mechanical, Materials & Mechatronics Engineerin, University of Wollongong, Wollongong, Australia.



Fig. S1 TGA curves of CPAN and CPAN/Se fiber under argon atmosphere.



Fig. S2 (a) SEM image of CPAN/Se fibers, (b) elemental information obtained by EDX chara cterization for the entire area ($62 \times 47 \ \mu m^2$) shown in (a). The detected Cu on the CPAN/Se fi ber sample is attributed to the copper substrate.



Fig. S3 Cycling performance of CPAN/Se fiber electrode at current density of 1.5 C (1000 mA g^{-1})forLi-Sebatteries.



Fig. S4 Cycling performance of pristine Se electrodes for Li-Se and Na-Se batteries tested at mA g^{-1} .



Fig. S5 Discharge/charge voltage profiles of CPAN, carbon black and PVDF composite (in the weight ratio of 75:15:10) for lithium-ion and sodium-ion batteries tested at 200 mA g^{-1} .



Fig. S6 EIS spectra of the CPAN/Se fiber cell before test and after cycles.



Fig. S7 (a) SEM image of CPAN/Se powders, (b) elemental information obtained by EDX ch aracterization for the entire area $(21 \times 16 \ \mu m^2)$ shown in (b). The detected Cu on the CPAN/S e powder sample is attributed to the copper substrate.



Fig. S8 (a) SEM image of PAN/Se powders and the corresponding elemental map images of (b) carbon and (c) selenium.



Fig. S9 (a) SEM images of CPAN/Se fiberS after 100 cycles for Li-Se batteries, and (b) corresponding elemental map images of carbon, nitrogen, fluorine, and selenium. The detected fluorine is attributed to the electrolyte (LiPF₆).