

## Supporting Information

# Simultaneous reinforcement of electrical and mechanical properties of carbon nanotube fibers by using natural cross-linkable thermosetting polymer

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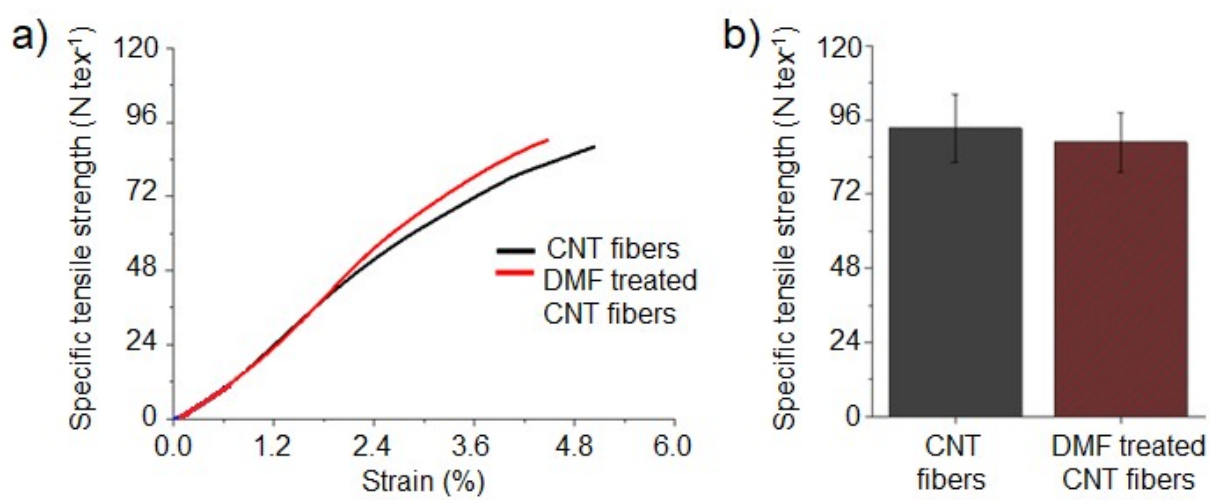
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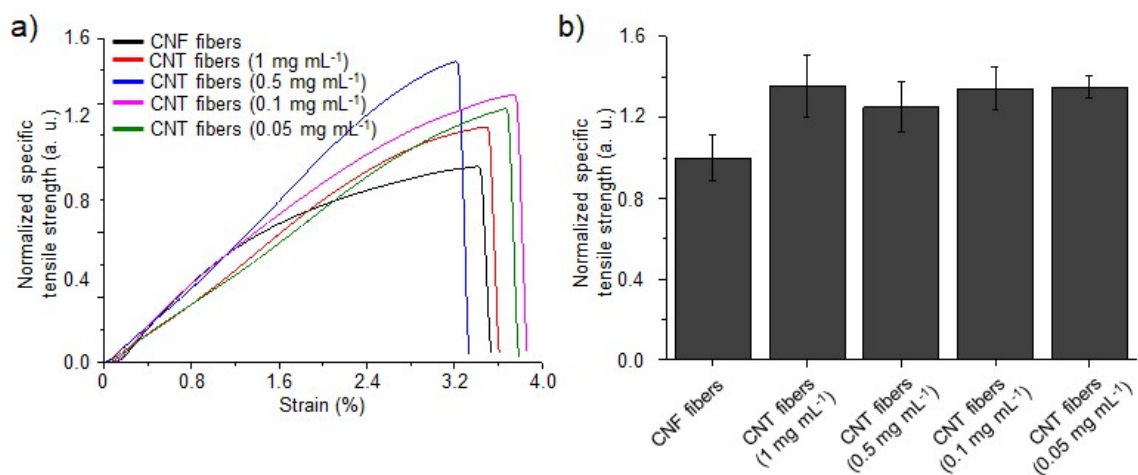
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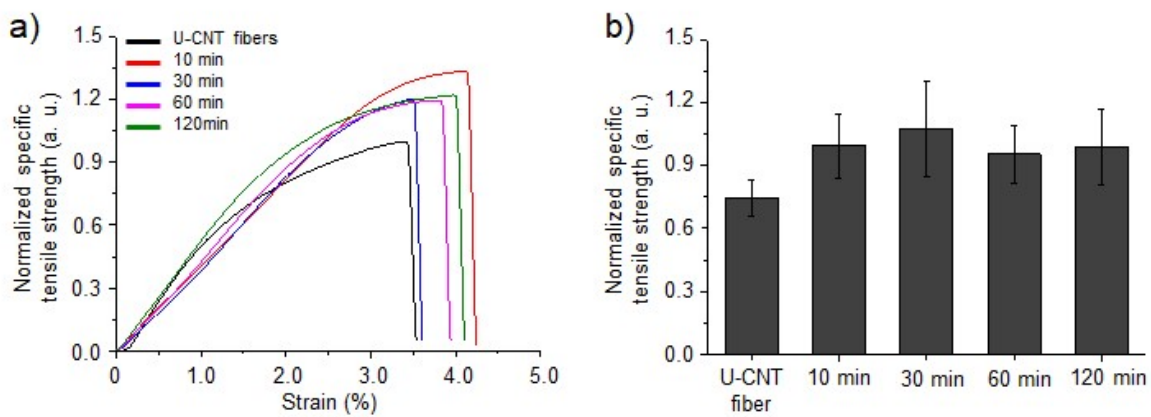
Supporting figure



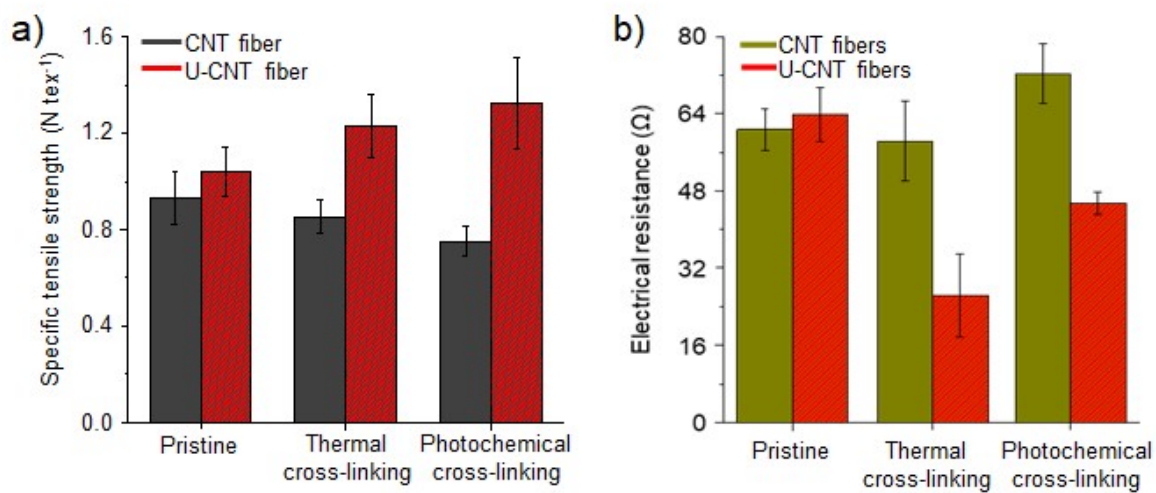
**Fig. S1.** a) Stress-strain curves and (b) specific tensile strength of CNT and DMF treated CNT fibers.



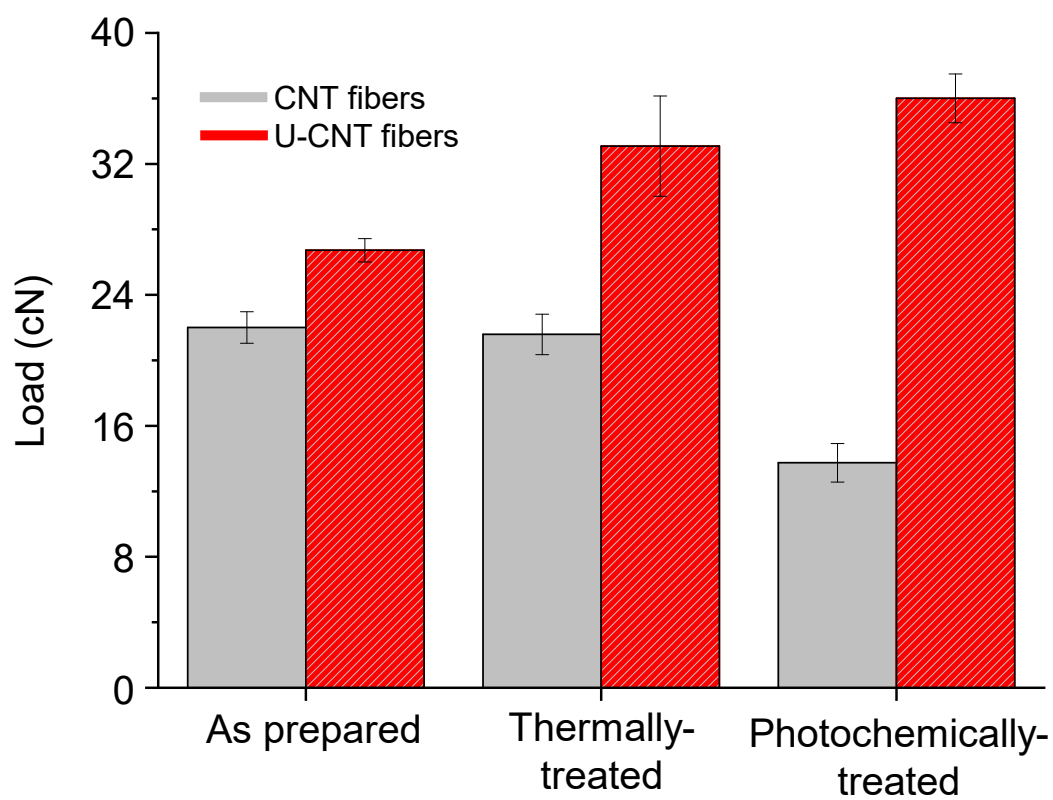
**Fig. S2.** a) Stress-strain curves and (b) normalized specific tensile strengths of CNT fibers and their counterparts incubated in differently concentrated DMF solutions of urushiol.



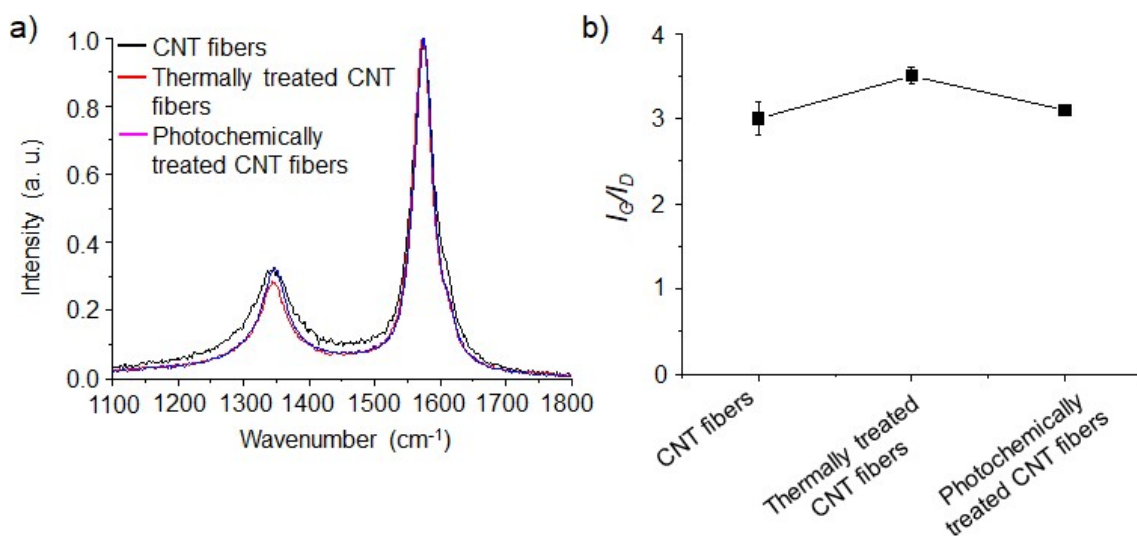
**Fig. S3.** a) Stress-strain curves and (b) normalized specific tensile strengths of U-CNT fibers and their counterparts exposed to UV light with different time.



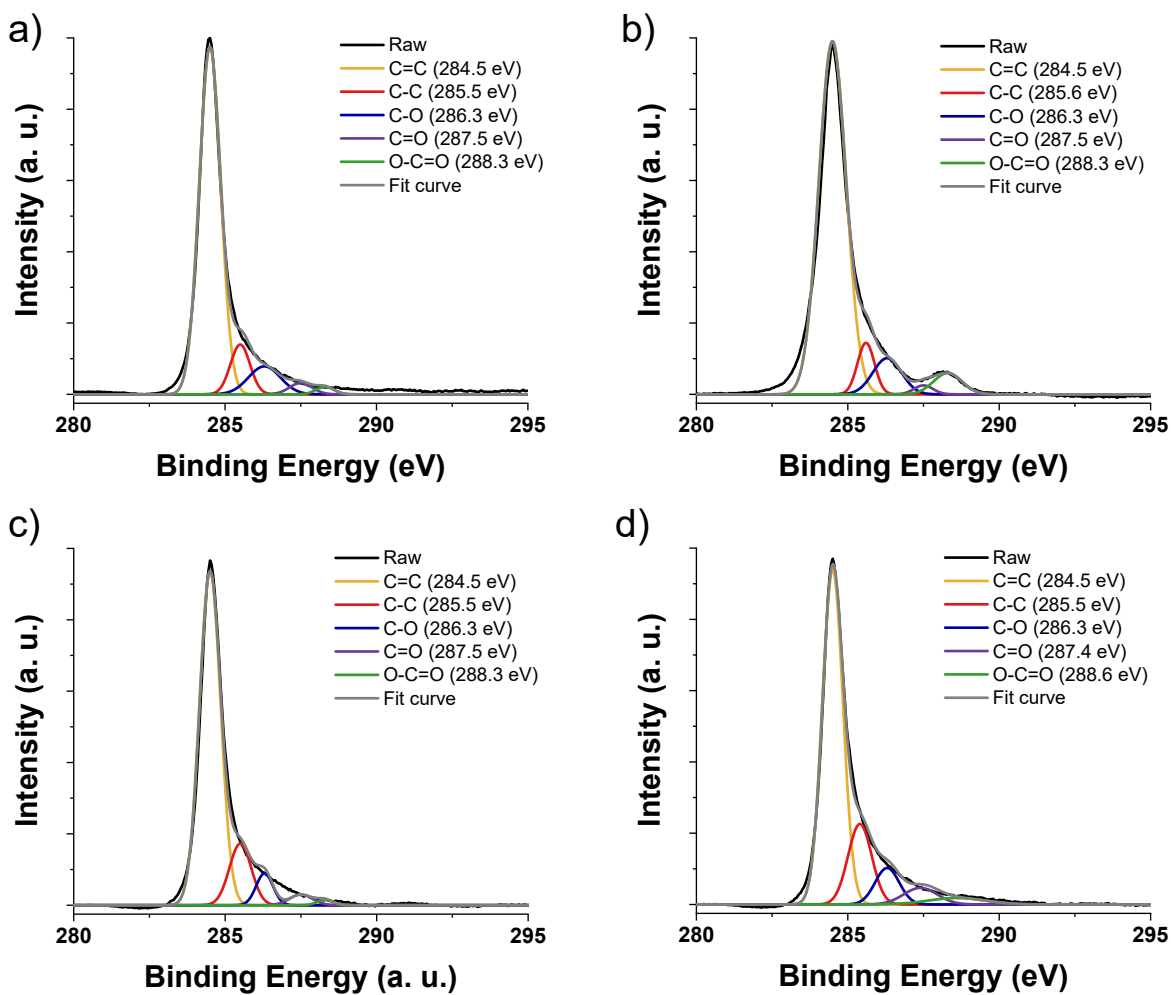
**Fig. S4.** The changes of (a) specific tensile strengths and (b) electrical resistance of CNT and U-CNT fibers by thermal and photochemical cross-linking conditions.



**Fig. S5.** The changes of load values of CNT and U-CNT fibers by thermal and photochemical cross-linking conditions.



**Fig. S6.** a) Raman spectra and (b)  $I_G/I_D$  values of CNT fibers and their counterparts treated by both thermal and photochemical cross-linking conditions, respectively.



**Fig. S7.** C 1s XPS spectra of (a) CNT, (b) U-CNT, (c) TC-U-CNT, and (d) PC-U-CNT fibers. C 1s XPS spectrum of CNT fibers was deconvoluted to 284.5, 285.5, 286.3, 287.5, and 288.3 eV corresponding to  $sp^2$  hybridized C=C,  $sp^3$  hybridized C-C, C-O, C=O, and O-C=O bonds, respectively.<sup>1</sup> After urushiol infiltration into CNT fibers, the relative intensities of C-O, C=O, and C=O bonds increased and this increase is well matched with the results of FT-IR analysis. After thermal and photochemical cross-linking treatments, the relative intensity of  $sp^3$  hybridized C-C bond was intensified with decrease of the relative intensities of oxygen containing bonds. These changes are also in good agreement with the results of FT-IR analysis (Fig. 5e, f) and implied the unsaturated groups in the side chain and phenol groups of urushiol decreased significantly. Those results of XPS analysis supported that the urushiol was successfully cross-linked on the surface of CNT fibers.

Reference



1. C. -J. Yoon, S. -H. Lee, Y. -B. Kwon, K. Kim, K. -H. Lee, S. Min Kim, Y. -K. Kim, *Appl. Surf. Sci.* 2021, **541**, 148332