

# ADVANCED OPTICAL MATERIALS

## Supporting Information

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Plasmonic-Enhanced Cholesteric Films: Coassembling  
Anisotropic Gold Nanorods with Cellulose Nanocrystals

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# Plasmonic-Enhanced Cholesteric Films: Co-assembling Anisotropic Gold

## Nanorods with Cellulose Nanocrystals

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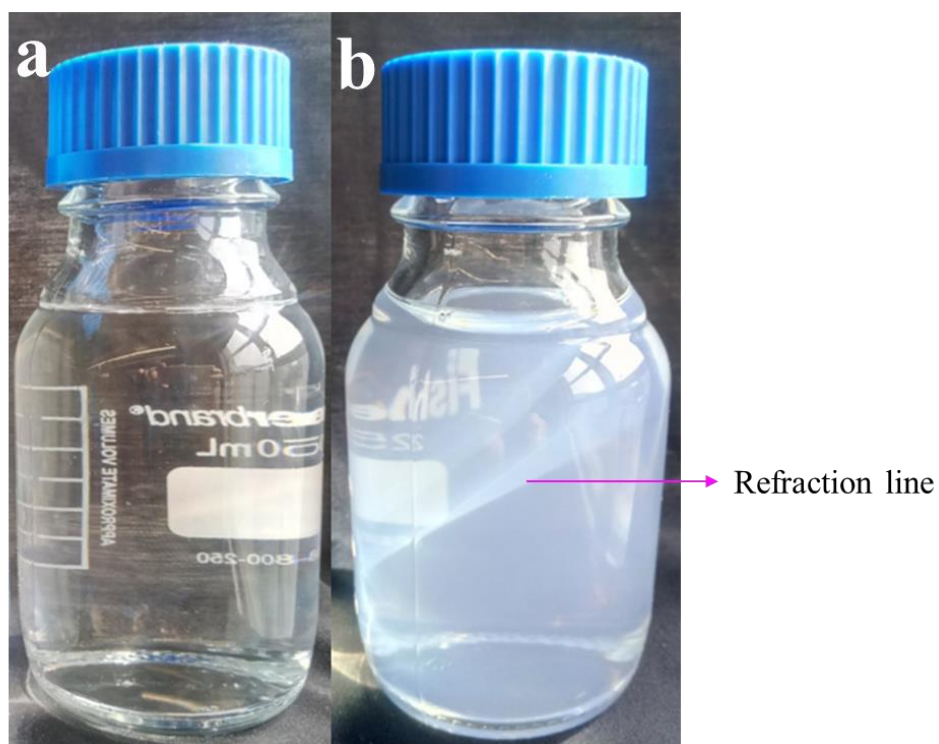
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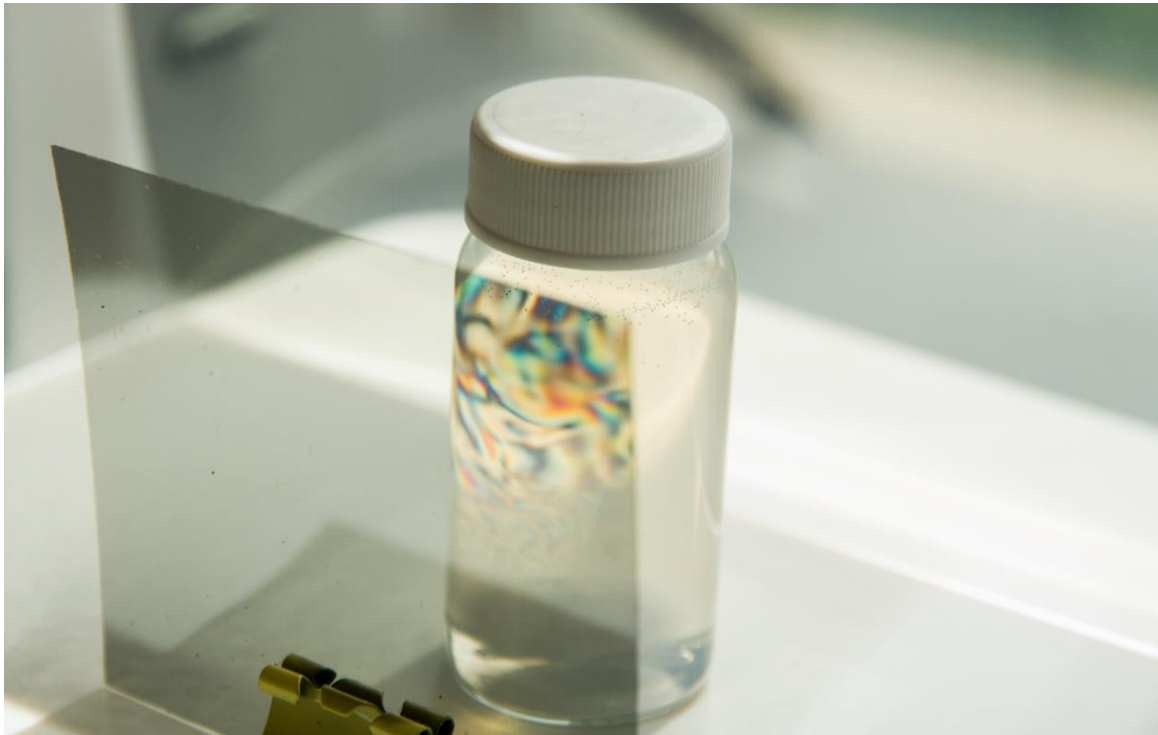
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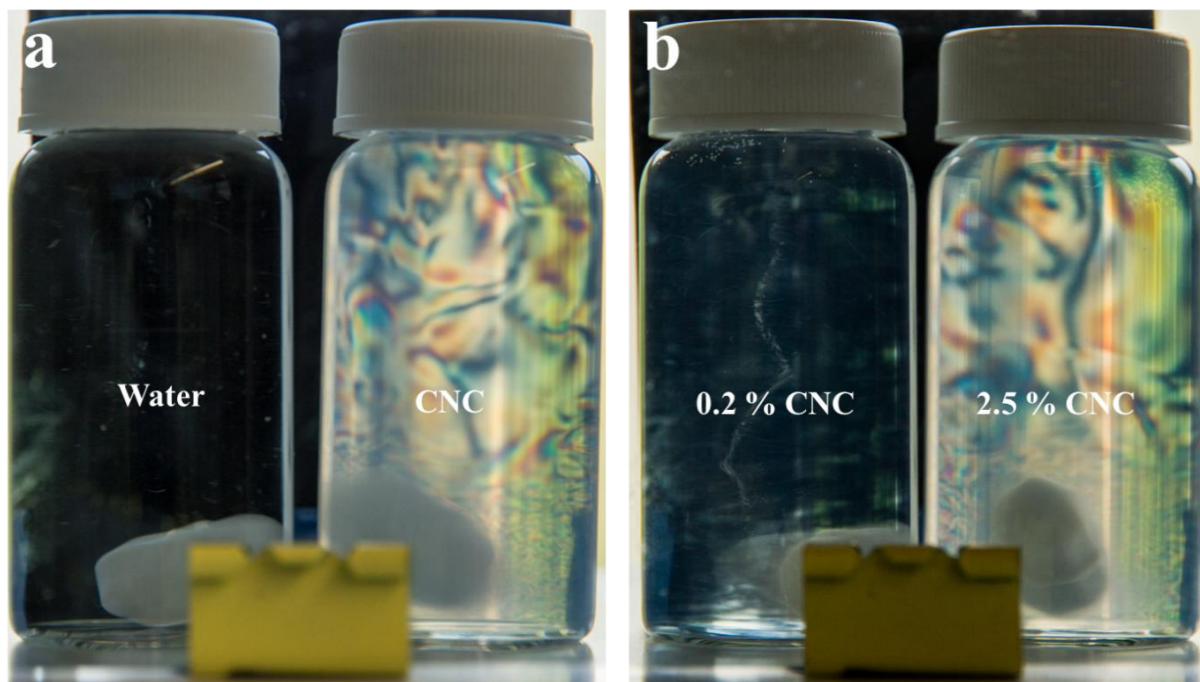
## Supplementary Results and Discussion



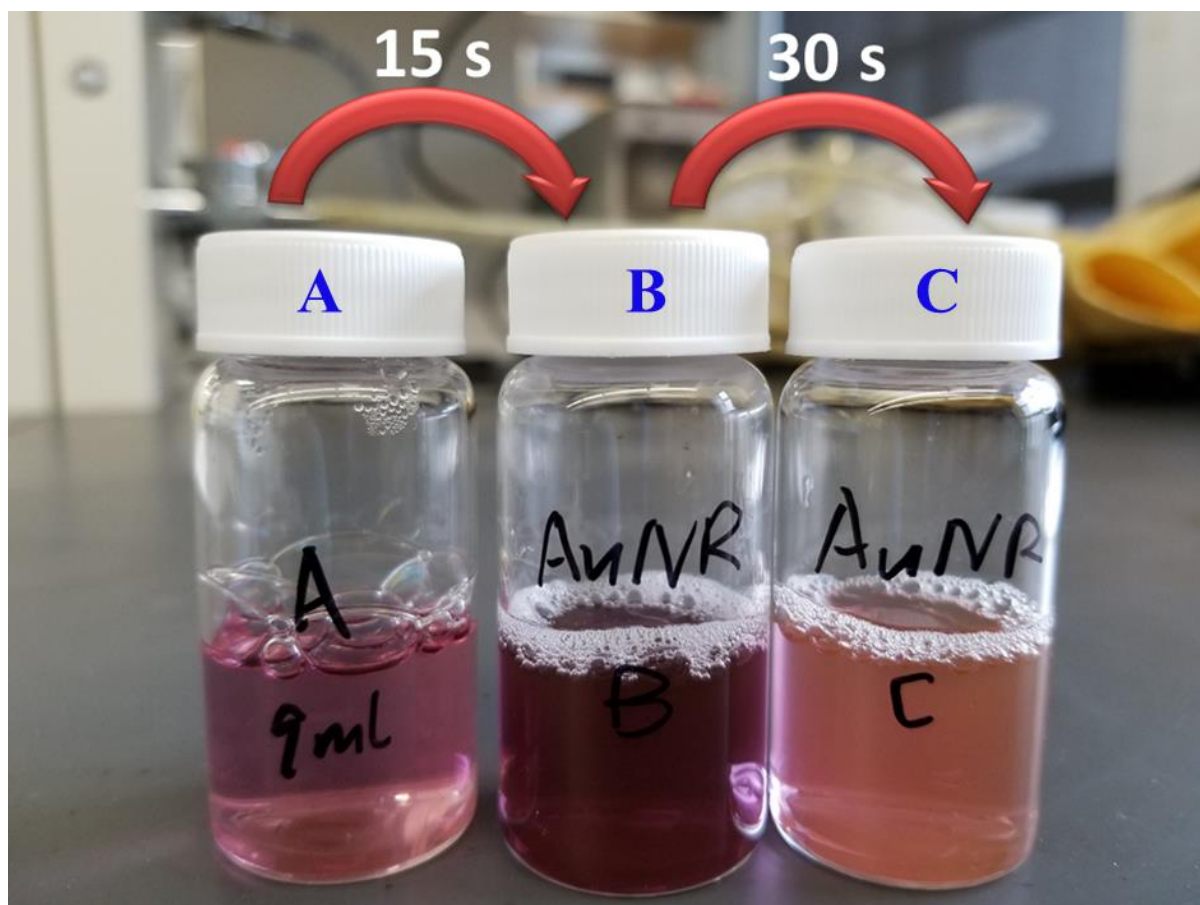
**Figure S1.** a) Water. b) 0.5 wt % CNC suspension as viewed by the naked eye, the transparent blue can be observed.



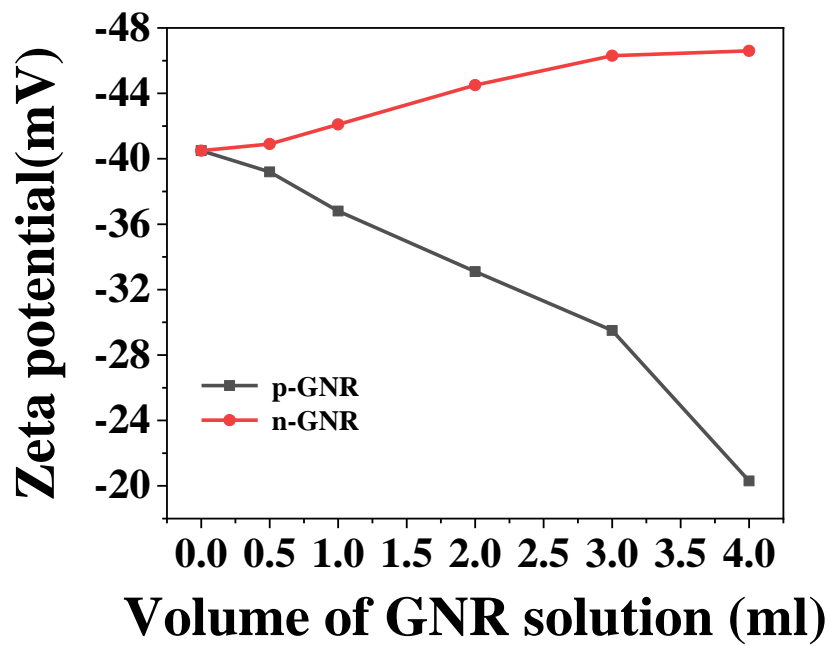
**Figure S2.** Birefringence patterns are observed through a polarizer on one side by placing the CNC solutions in the middle of two crossed polarizers.



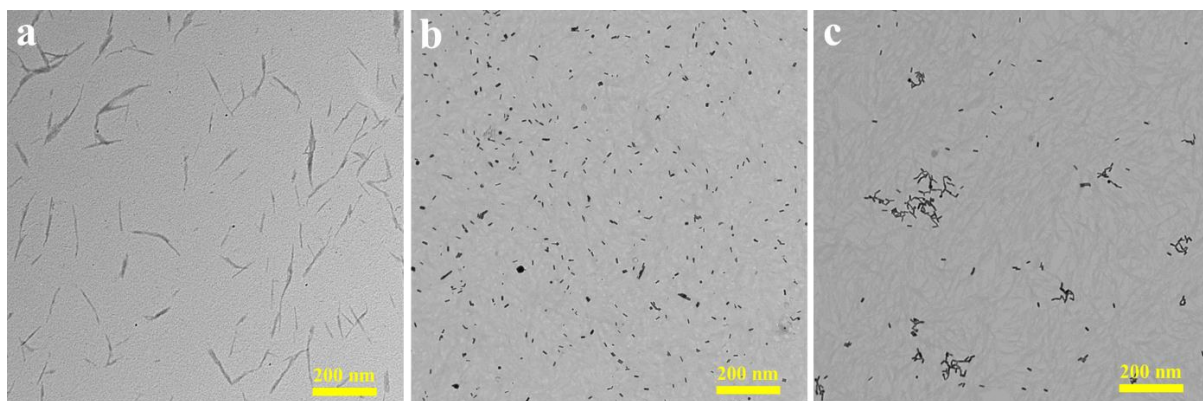
**Figure S3.** a) The birefringence patterns can not be observed in the water (left), while the birefringence patterns are observed in the CNC suspension (right), indicating the characteristic feature of an anisotropic liquid crystal of CNC suspension. b) The birefringence patterns can not be observed if the concentration is too low (left), and the patterns are obvious when the concentration reach to 2.5 wt % (right).



**Figure S4.** Three-step seed-mediated growth method to prepare gold nanorods.

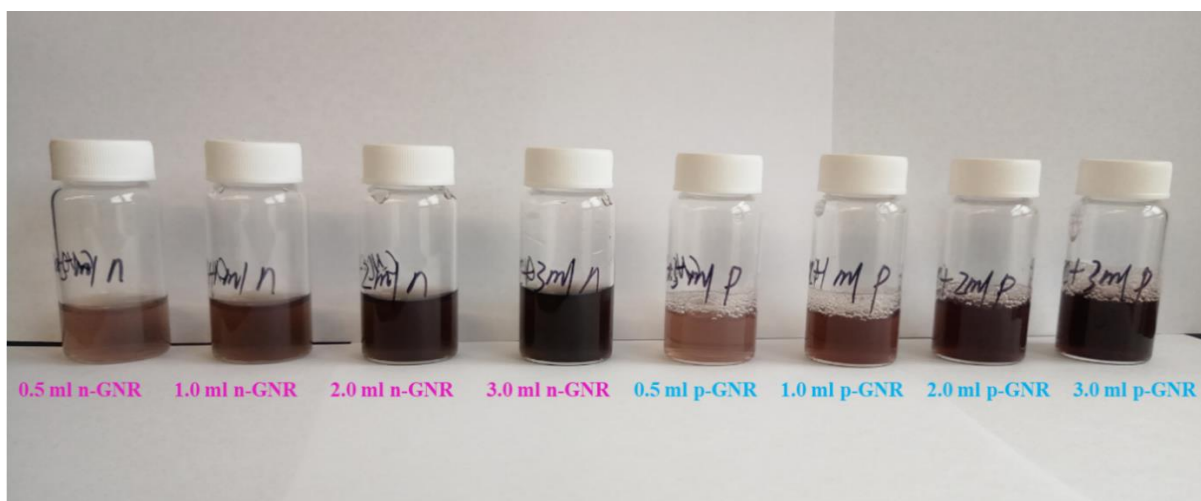


**Figure S5.** Effect of volume of n-GNR and p-GNR solution on the  $\zeta$ -potential of the mixed suspension.

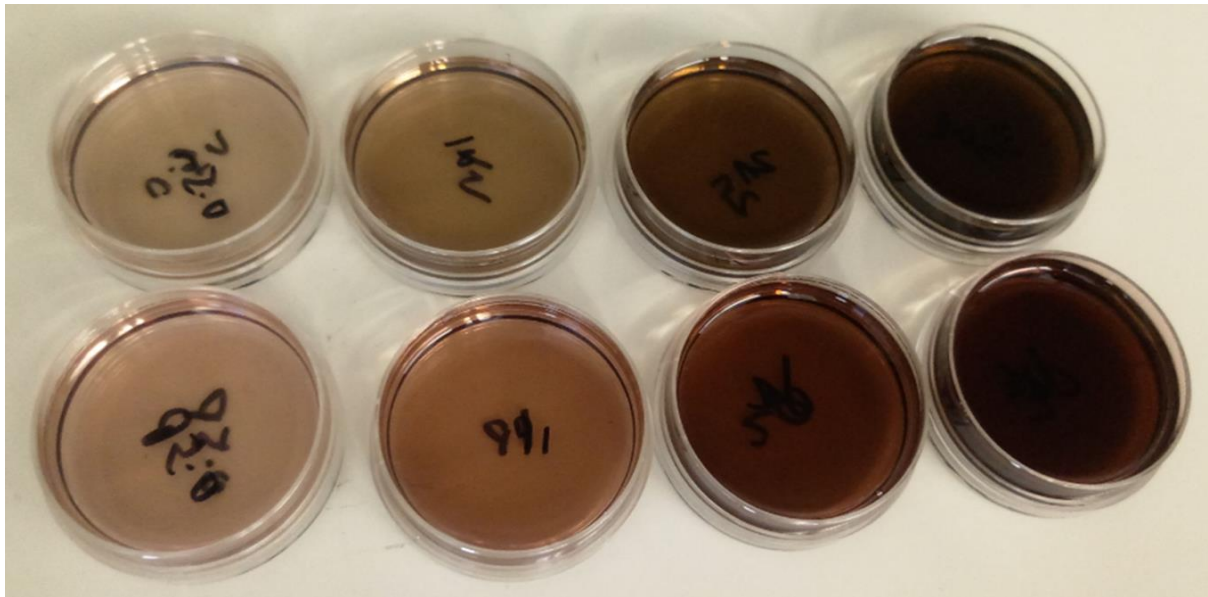


**Figure S6.** a-c) TEM image of CNC with PEG, CNC/n-GNR mixture, and CNC/p-GNR mixture.

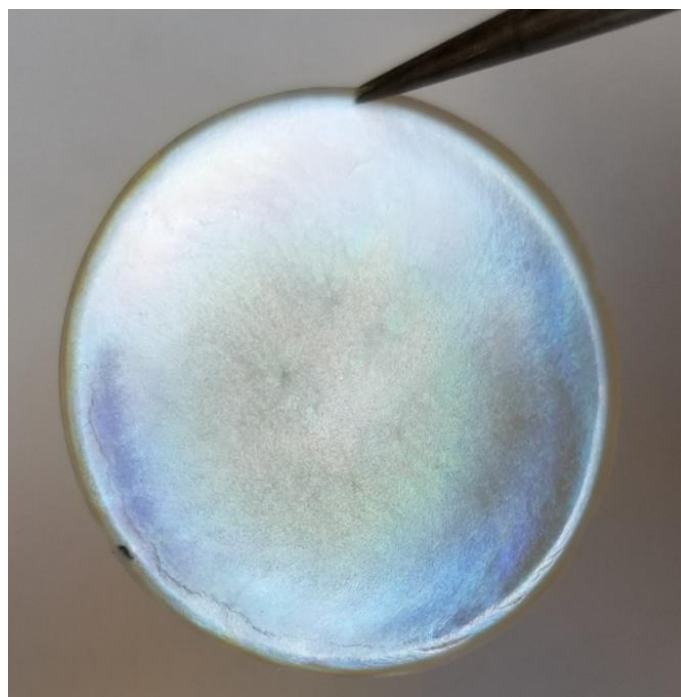




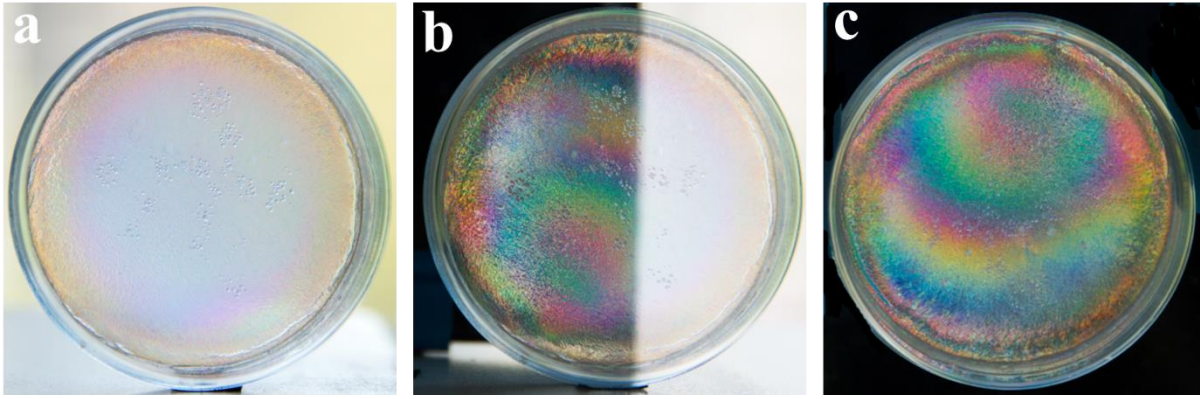
**Figure S7.** Visual images of 5.0 ml of 3 wt % CNC suspensions mixed with different concentration of n-GNR or p-GNR (4.0 nM) suspensions.



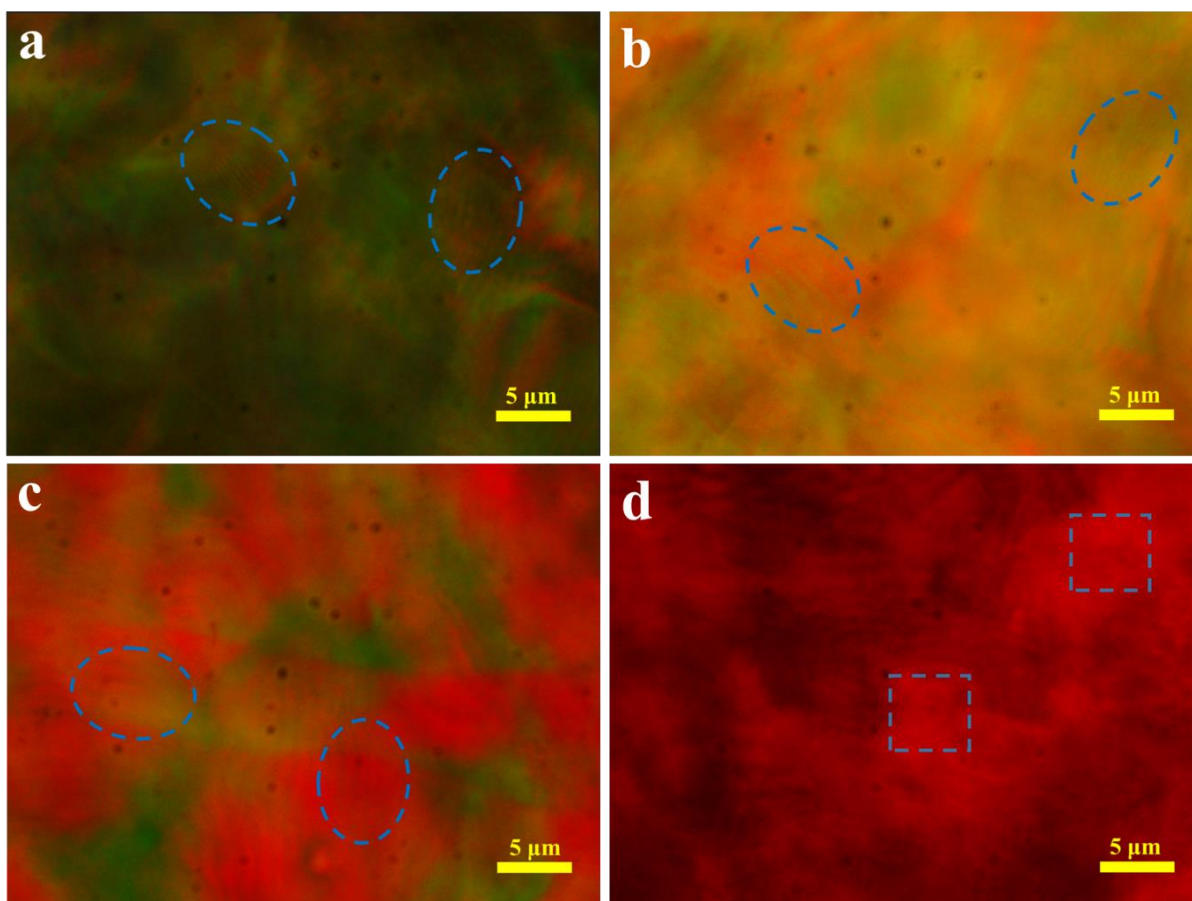
**Figure S8.** Different concentration of n-GNR or p-GNR suspension mixed with CNC suspension and drop-casted into the petri dish to prepare the CNC/GNR hybrid films.



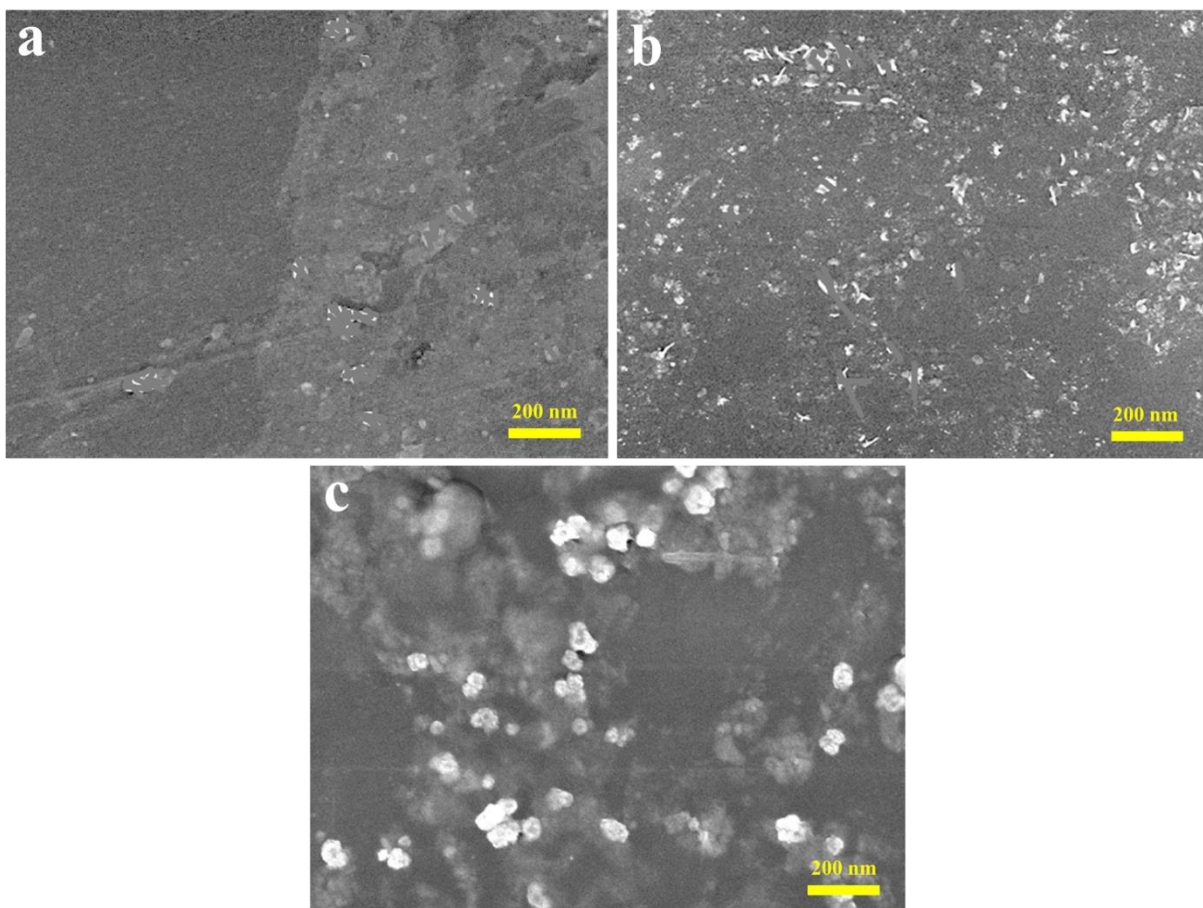
**Figure S9.** Free-standing pure CNC film obtained by drying 5.0 ml of 3.0 wt % CNC suspension at ambient condition.



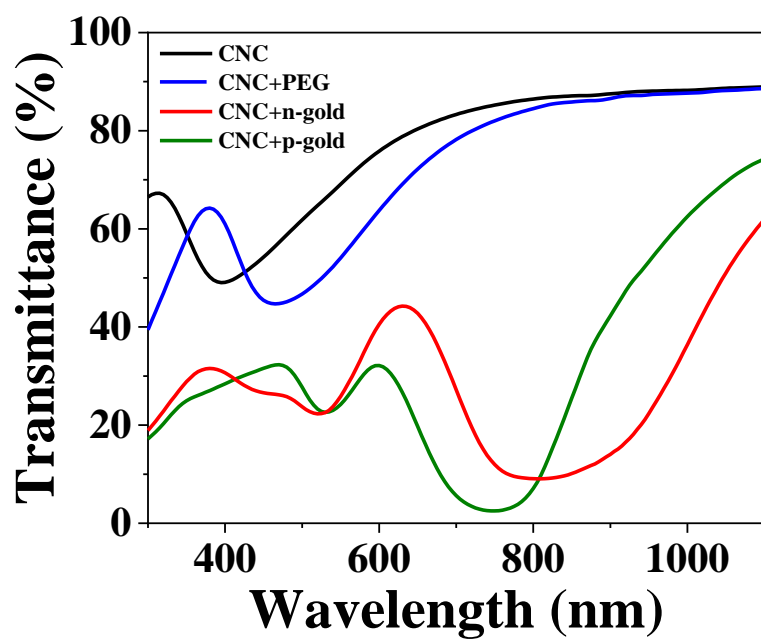
**Figure S10.** Iridescent color observed when the pure CNC films were placed under the polarizers. a) CNC film placed under sunlight transmission. b) CNC film placed under half polarizers and half direct sunlight. c) CNC film placed between crossed polarizers.



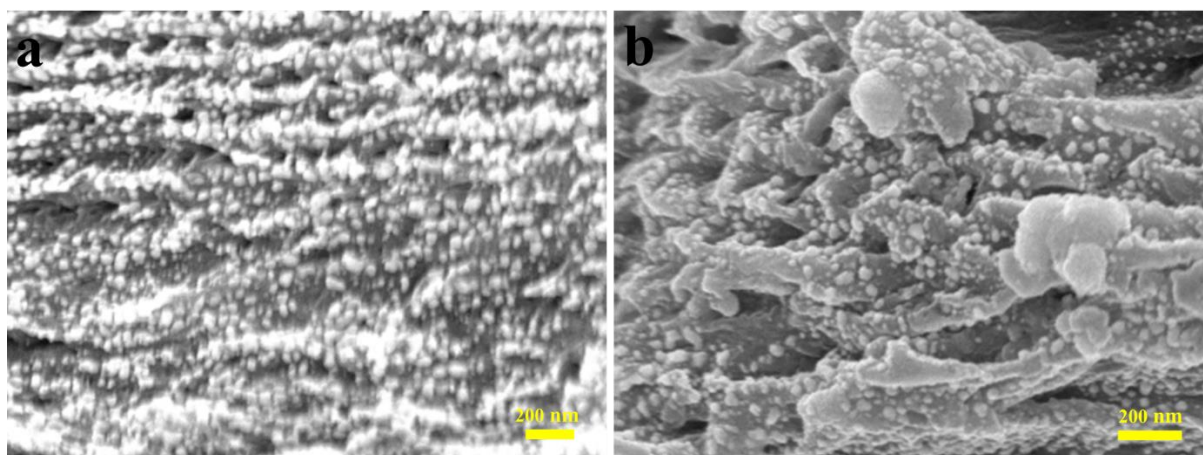
**Figure S11.** High-magnification POM image of the surface of a) CNC film, b) CNC/PEG hybrid film, c) CNC/n-GNR hybrid film, and d) CNC/p-GNR hybrid film. The dotted ellipse/square (planar texture with spaced parallel lines) indicates the fingerprint pattern.



**Figure S12.** a) SEM images of the surface of CNC film. b) SEM images of the surface of CNC/n-GNR hybrid film. c) SEM images of the surface of CNC/p-GNR hybrid film.



**Figure S13.** UV-vis spectra of the CNC, CNC+PEG, CNC/n-GNR (5.0 ml CNC: 2.0 ml GNR), and CNC/p-GNR (5.0 ml CNC: 2.0 ml GNR) hybrid films.



**Figure S14.** SEM cross-section images: a) CNC/n-GNR hybrid films (5.0 ml of 3.0 wt % CNC+4.0 ml of 4.0 nM n-GNR mixed suspension); b) CNC/p-GNR hybrid films (5.0 ml of 3.0 wt % CNC+4.0 ml of 4.0 nM p-GNR mixed suspension).



**Table S1.** Volume of 4.0 nM GNR solution added to 5.0 mL of 3.0 wt % CNC suspension, and  $\zeta$ -potential of the mixed suspension. The hybrid films of CNC and GNR (denoted as CNC/GNR).

Notation	Volume of GNR suspension (ml)	Ratio of GNR in suspension (vol %)	$C_{\text{GNR}}$ in mixed suspensions (nM)	Mass fraction of GNR in films (wt %)	Zeta potential (mV)
CNC	0	0	0	0	-40.5
n-GNR	—	—	—	—	-46.8
CNC/0.5 n-GNR	0.5	9.1	0.36	0.174	-40.9
CNC/1.0 n-GNR	1.0	16.7	0.67	0.327	-42.1
CNC/2.0 n-GNR	2.0	28.6	1.14	0.562	-44.3
CNC/3.0 n-GNR	3.0	37.5	1.50	0.739	-46.2
CNC/4.0 n-GNR	4.0	44.4	1.78	0.877	-46.5
p-GNR	—	—	—	—	+29.4
CNC/0.5 p-GNR	0.5	9.1	0.36	0.168	-39.2
CNC/1.0 p-GNR	1.0	16.7	0.67	0.332	-36.8
CNC/2.0 p-GNR	2.0	28.6	1.14	0.559	-33.1
CNC/3.0 p-GNR	3.0	37.5	1.50	0.742	-29.5
CNC/4.0 p-GNR	4.0	44.4	1.78	0.873	-19.8