Supporting Information

Controlling the Optical Properties of Chiral Nematic Mesoporous Organosilica Films with Bioadditives

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Characterization methods

- CD and UV-vis spectra were measured using a JASCO J-815 spectropolarimeter. Spectra were collected by mounting free-standing films so that the surfaces of the films were perpendicular to the beam path.
- Elemental analysis (EA) was performed on a Thermo Flash 2000 Elemental Analyzer.
- FT-IR spectra were obtained with a FT-IR Perkin Elmer Frontier spectrometer equipped with ATR (diamond/ZnSe); resolution: 4 cm^{-1}; 4 scans; wavelength range: 4000 – 600 cm^{-1}.
- POM images were collected on an Olympus BX53M polarized optical microscope with associated Stream Basic software. Images were captured between crossed polarizers using a 20x objective lens in transmittance mode.
- Thermogravimetric analysis (TGA) was performed on a Netzsch TGA209 F1 Libra thermogravimetric analyzer under air. Samples were heated under air from 30 to 600°C at 10 °C min^{-1}.
- N_2 sorption isotherms were collected at 77 K on an accelerated surface area and porosimetry (ASAP) 2020 analyzer (Micrometrics). Prior to analysis, film samples (~100 mg) were degassed at 100 °C for 16 h. Nitrogen sorption isotherms were collected and evaluated using Brunauer–Emmett–Teller (BET) and Barrett-Joyner-Halenda (BJH) methods for surface area and pore size analysis, respectively.
- Scanning Electron Microscopy (SEM) images were collected on a Zeiss Crossbeam 350 FIB-SEM electron microscope. Samples were prepared by breaking the films into small pieces and attaching these to aluminum stubs using double-sided adhesive tape. Samples were sputter-coated with 5 nm of gold prior to imaging. Images were collected at an accelerating voltage of 2.0 kV with a 30 µm aperture and working distance of 5 mm.
- TEM images were collected on a FEI Tecnai G20 Twin TEM transmission electron microscope. Images were collected at 120 kV.
- Zeta (ζ) potential and dynamic light scattering (DLS) were measured using a Brookhaven NanoBrook Omni Dynamic Light Scattering instrument. All analyses were conducted at room teperature (20 °C). For each measurement, 1.5 mL of fresh CNC suspension was dispensed into a polystyrene cuvette. Samples were measured three times, with reported values for *z*-average diameter and ζ-potential expressed as averages ± standard deviations.

Analysis data

CNC suspension

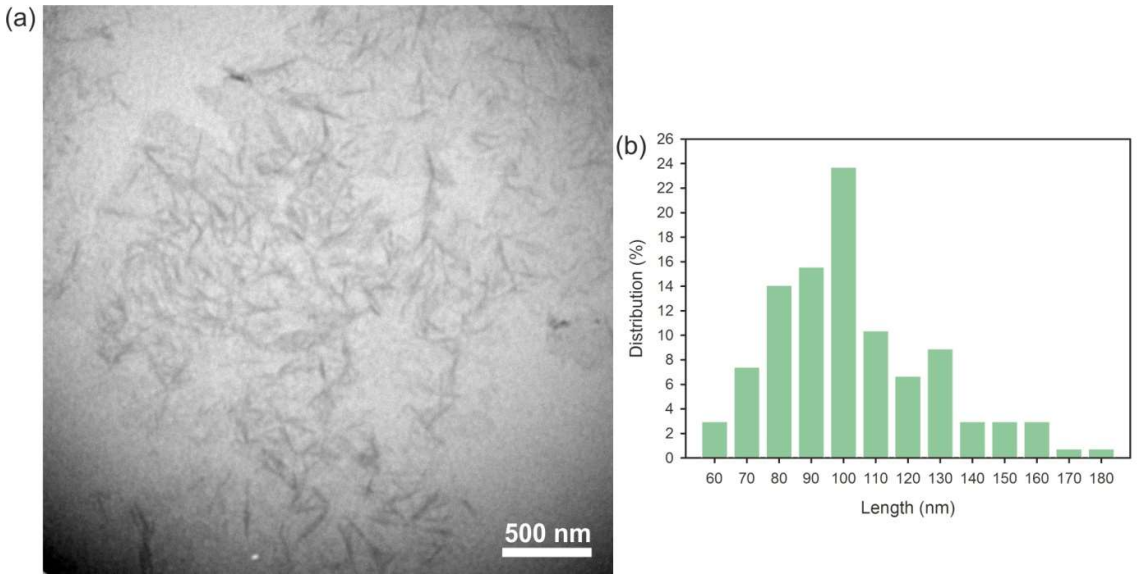

Figure S1. (a) TEM image of the CNC suspension. (b) Length distribution of CNCs (number of analyzed nanoparticles: 135). The mean size for CNCs is (108 ± 24) nm.

Photographs

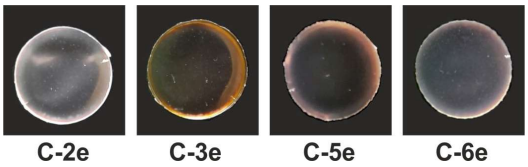

Figure S2. Photographs of select non-cracked composite films prepared from CNCs, organosilica precursor and additives (glucose, sucrose, PEG-400 or PEG-20,000). The diameter of each of sample is 2.5 cm.

Elemental analysis

Table S1. Elemental analysis results of **Et-CNMO-1**, and **Et-CNMO-2e**–**6e** samples.

sample	N (%)	C (%)	H (%)
Et-CNMO-1	0	13.42	3.42
Et-CNMO-2e	0	10.46	4.40
Et-CNMO-3e	0	10.37	3.76
Et-CNMO-4e	0	11.32	3.89
Et-CNMO-5e	0	11.11	4.60
Et-CNMO-6e	0	12.70	4.33

ATR-FT-IR spectra

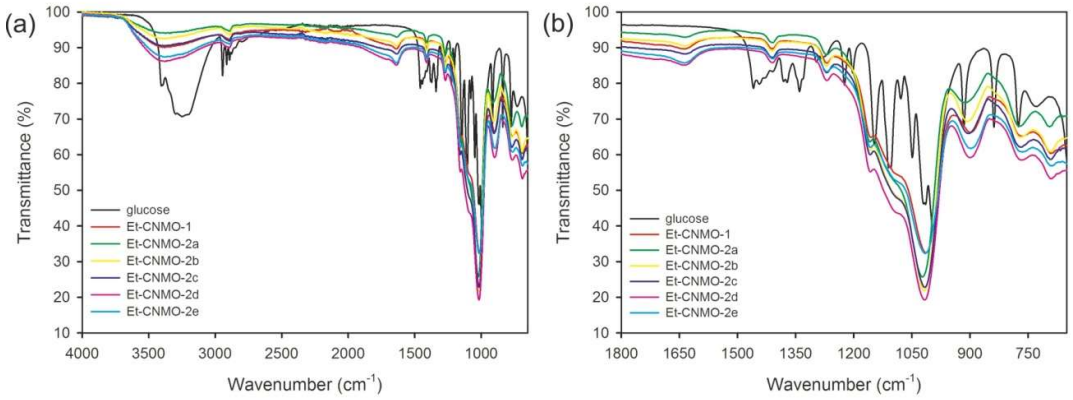

Figure S3. IR spectra measured for glucose, **Et-CNMO-1** and **Et-CNMO-2**; (a) full spectral range, (b) zoomed range.

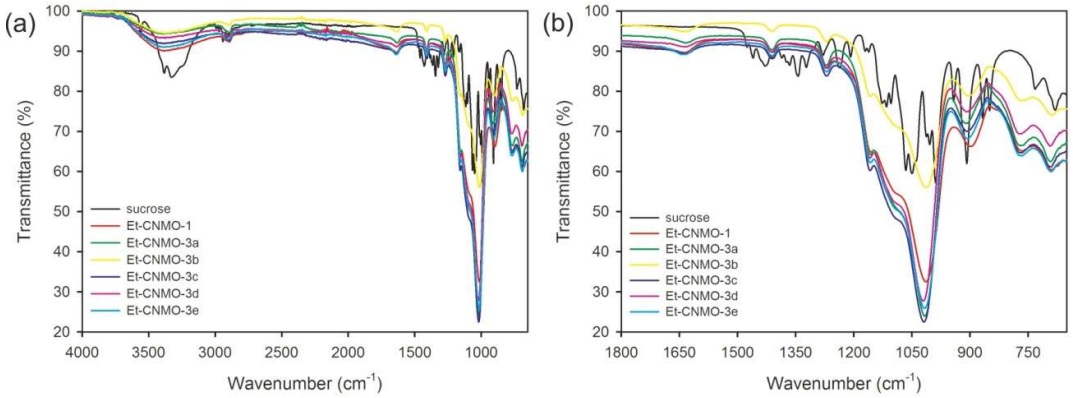

Figure S4. IR spectra measured for sucrose, **Et-CNMO-1** and **Et-CNMO-3**; (a) full spectral range, (b) zoomed range.

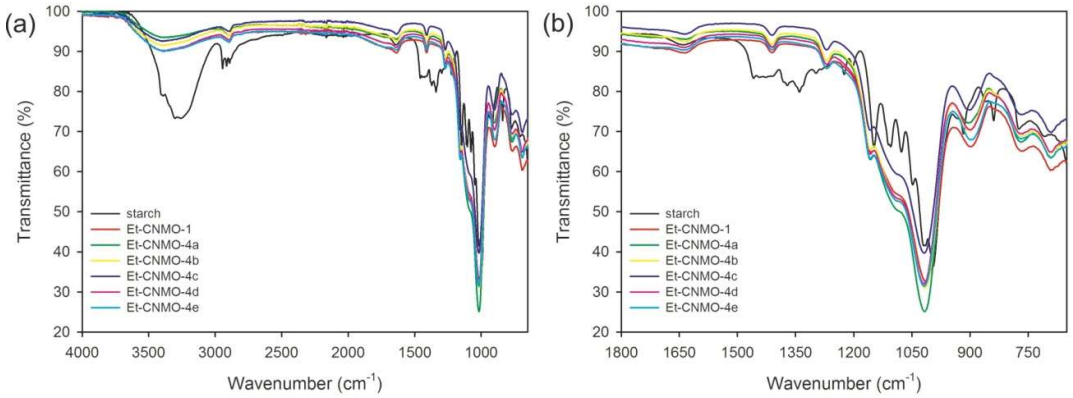

Figure S5. IR spectra measured for starch, **Et-CNMO-1** and **Et-CNMO-4**; (a) full spectral range, (b) zoomed range.

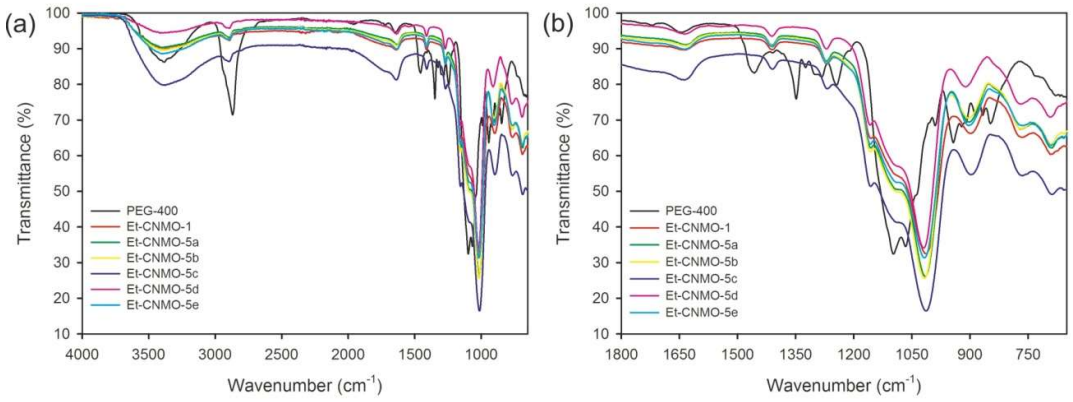

Figure S6. IR spectra measured for PEG-400, **Et-CNMO-1** and **Et-CNMO-5**; (a) full spectral range, (b) zoomed range.

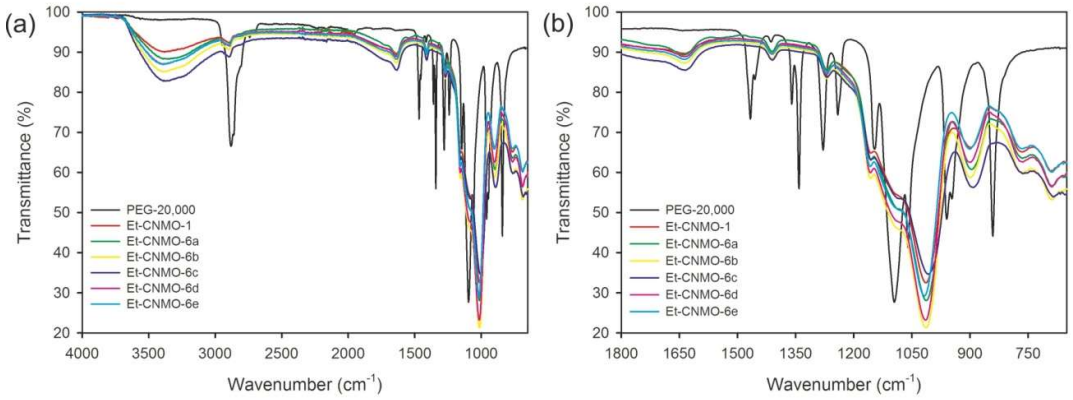

Figure S7. IR spectra measured for PEG-20,000, **Et-CNMO-1** and **Et-CNMO-6**; (a) full spectral range, (b) zoomed range.

CD spectra

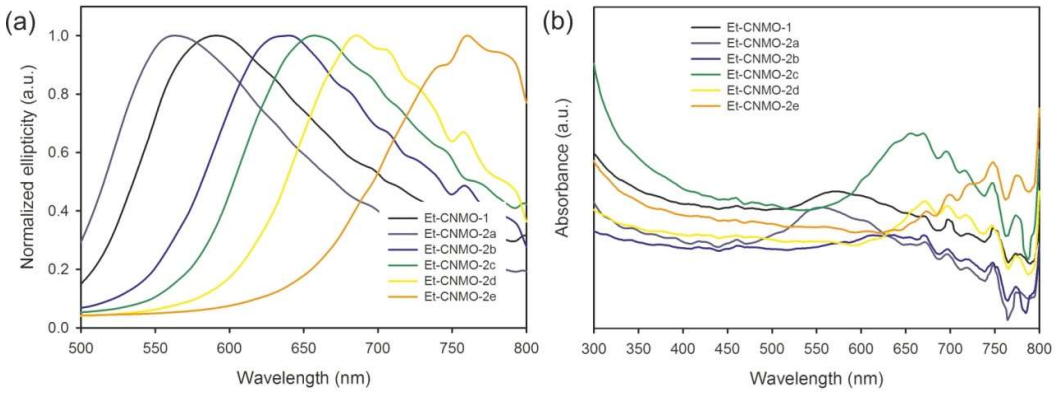

Figure S8. (a) CD spectra and (b) UV-vis spectra* measured for **Et-CNMO-1** and **Et-CNMO-2** organosilica films.

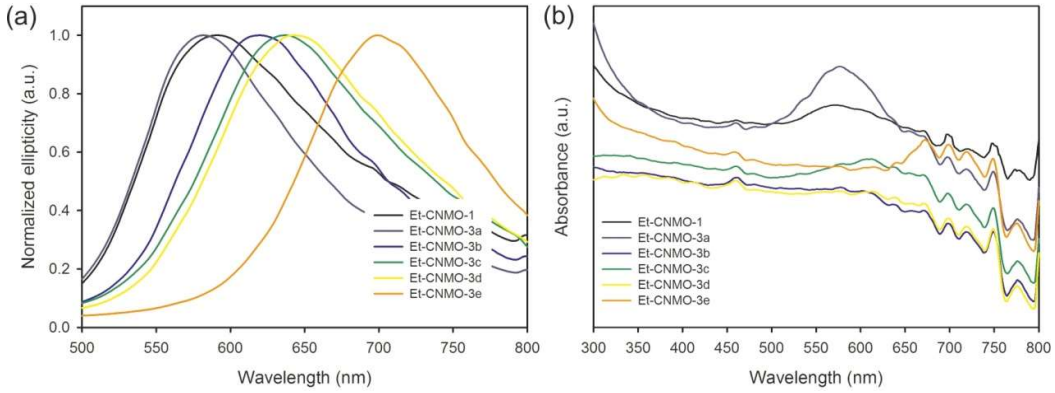

Figure S9. (a) CD spectra and (b) UV-vis spectra measured for **Et-CNMO-1** and **Et-CNMO-3** organosilica films.

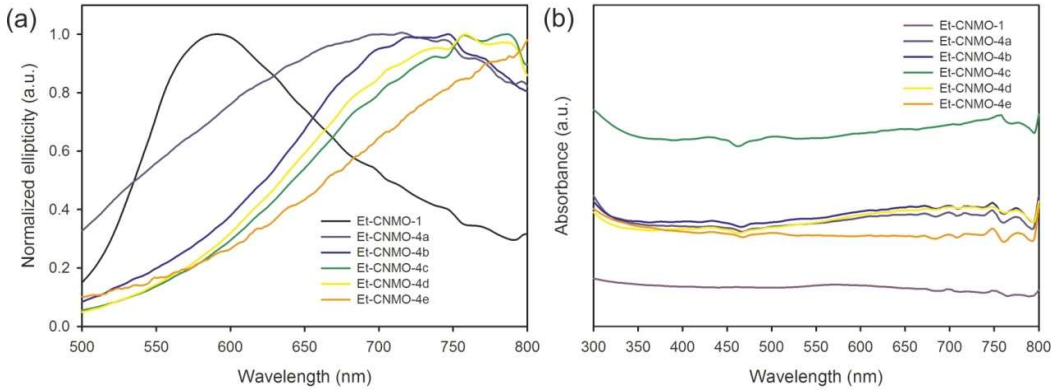

Figure S10. (a) CD spectra and (b) UV-vis spectra* measured for **Et-CNMO-1** and **Et-CNMO-4** organosilica films.

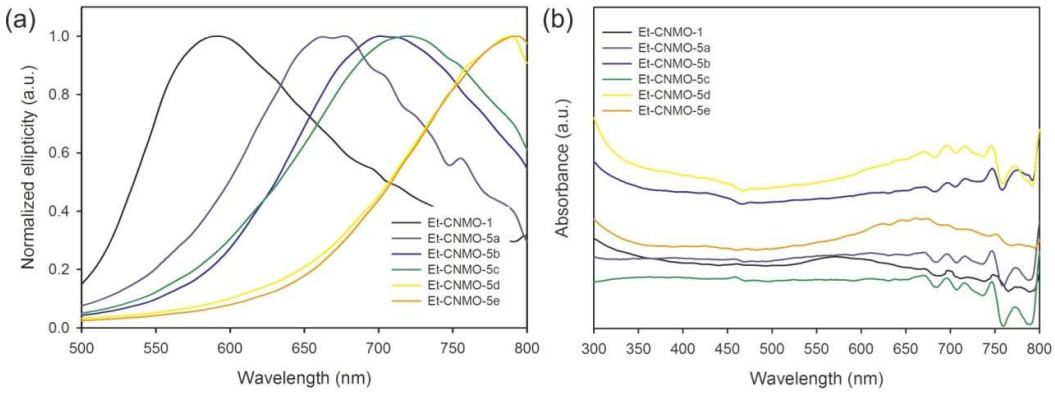

***Figure S11*.** (a) CD spectra and (b) UV-vis spectra* measured for **Et-CNMO-1** and **Et-CNMO-5** organosilica films.

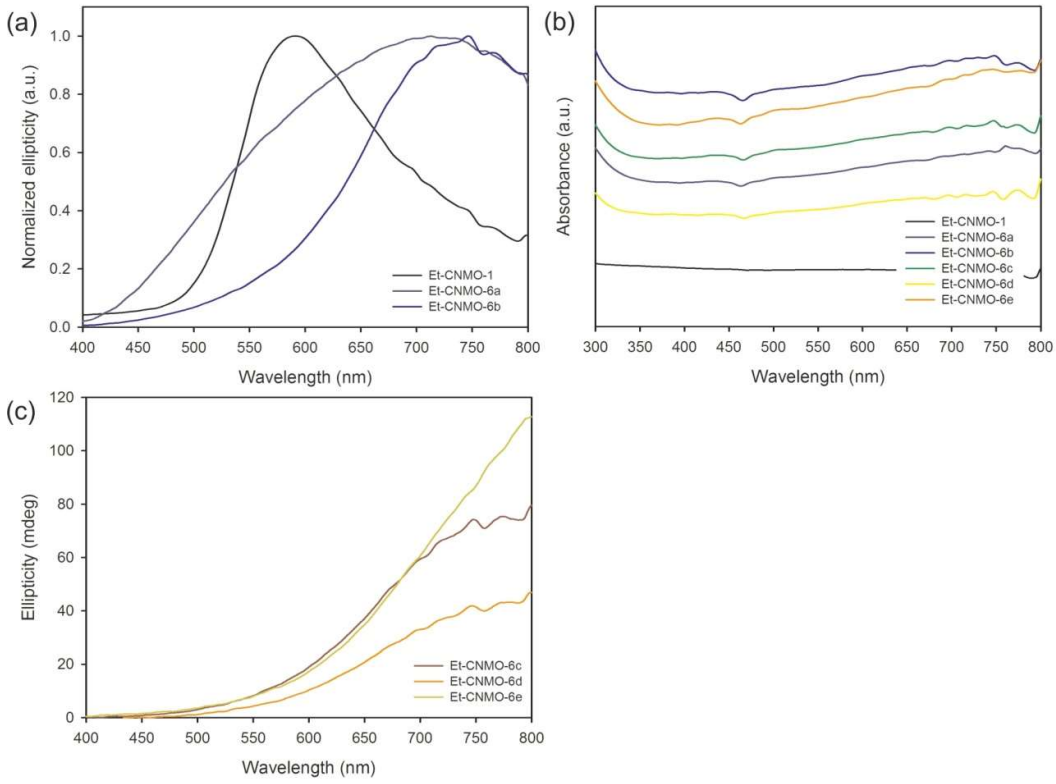

***Figure S12*.** (a) CD spectra measured for **Et-CNMO-1** and **Et-CNMO-6a**,**b** organosilica films. (b) UV-vis spectra measured for **Et-CNMO-1** and **Et-CNMO-6** organosilica films. (c) CD spectra measured for **Et-CNMO-6c**-**e** organosilica films.

*Note: In the low-energy region, above 700 nm, vibration modes from the silica may appear in the UV-vis spectra; these are especially visible if the absorption of the tested material is low, and there is a relatively thick layer of microscope glass.

Table S2. Wavelength (nm) at the maximum reflection from measured CD spectra for Et-CNMO films (* – estimated values due to glass absorbance range; ** – values outside the spectral range).

samples	Et-CNMO-2	Et-CNMO-3	Et-CNMO-4	Et-CNMO-5	Et-CNMO-6
A	562	582	715	677	713
B	640	620	747	701	747
C	657	637	>760*	719	>800**
D	684	642	>760*	789*	>800**
E	759	699	>800**	792*	>800**

N_2 sorption analysis

Table S3. Results of nitrogen sorption analysis for organosilica films **Et-CNMO-1**, **Et-CNMO-2**, and **Et-CNMO-3**. Nitrogen sorption isotherms were collected and evaluated using Brunauer–Emmett–Teller (BET) and Barrett-Joyner-Halenda (BJH) methods for surface area and pore size analysis.

Sample	BET surface area (m^2/g)	Pore volume (cm^3/g)	Pore size (nm)
Et-CNMO-1	521	0.85	6.26
Et-CNMO-2a	436	0.89	7.98
Et-CNMO-2b	955	1.80	7.98
Et-CNMO-2c	847	1.45	6.53
Et-CNMO-2d	716	1.54	8.78
Et-CNMO-2e	556	1.06	7.81
Et-CNMO-3a	492	0.84	6.57
Et-CNMO-3b	868	1.05	7.12
Et-CNMO-3c	747	1.59	8.14
Et-CNMO-3d	493	1.33	11.02
Et-CNMO-3e	562	0.84	5.85

POM images

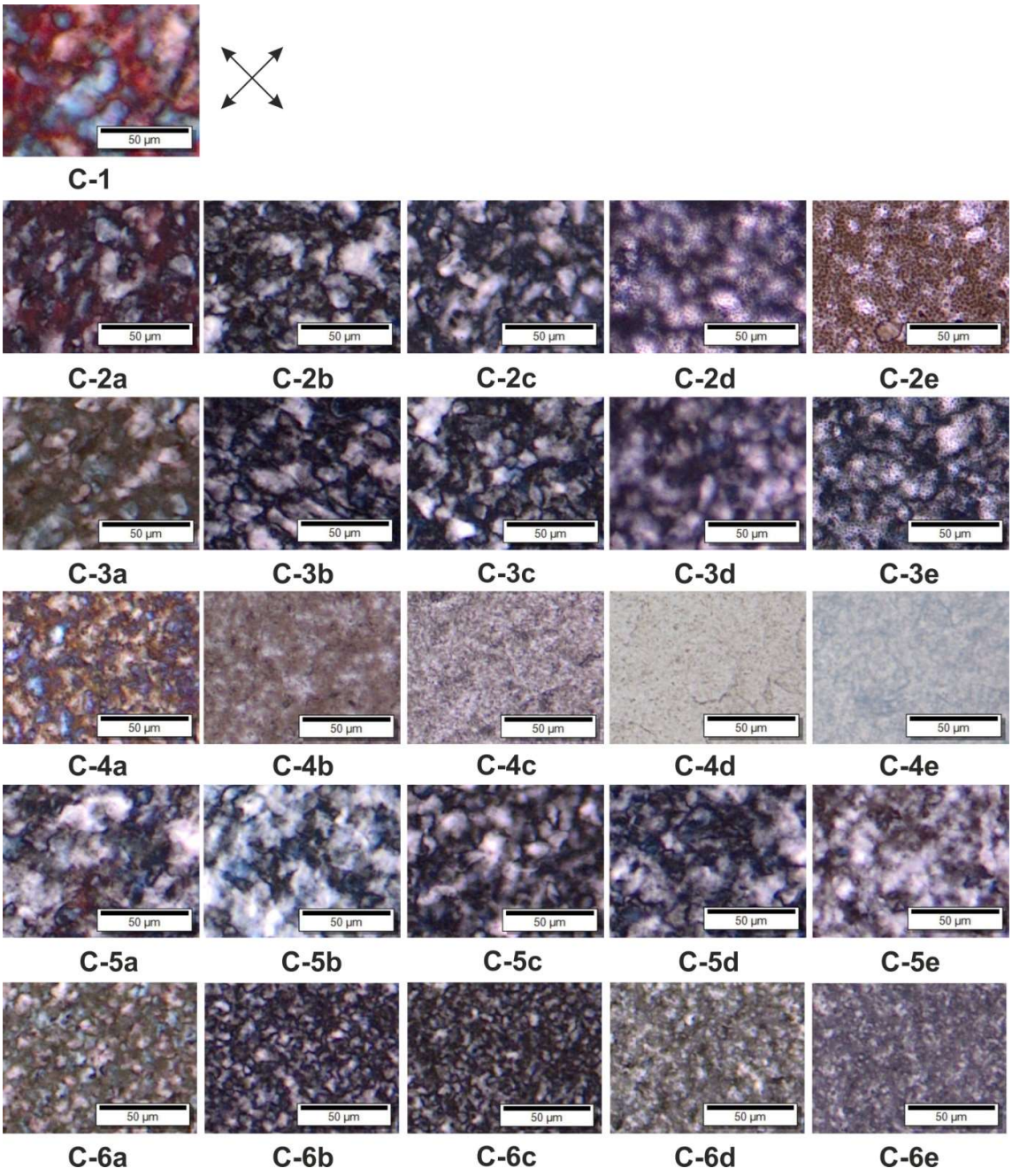

Figure S13. Polarized optical microscopy (POM) images of all composite films. Images were captured between crossed polarizers using a 20x objective lens in transmittance mode. Scale bars are 50 µm.

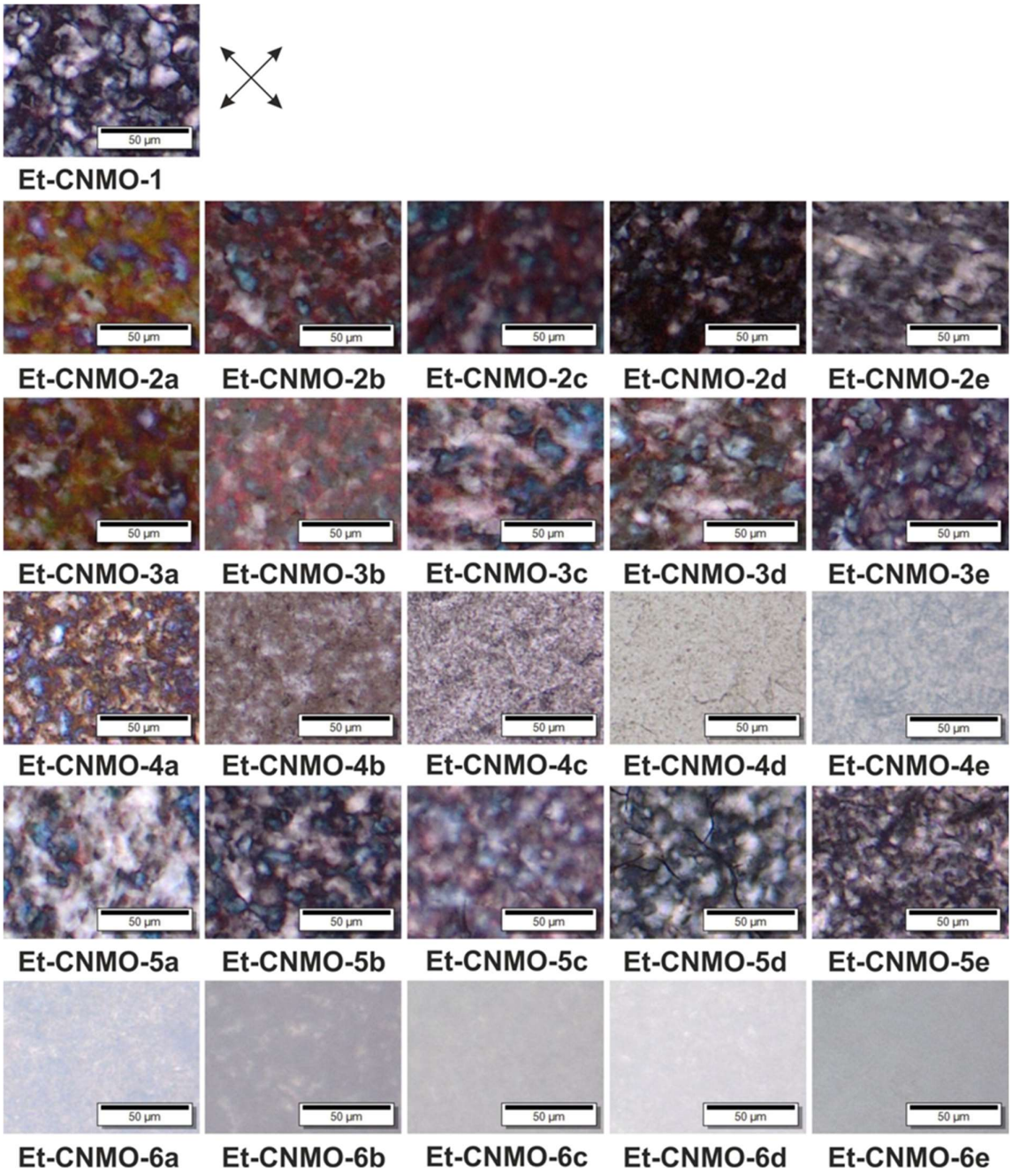

Figure S14. Polarized optical microscopy (POM) images of all CNMO films. Images were captured between crossed polarizers using a 20x objective lens in transmittance mode. Scale bars are 50 µm.

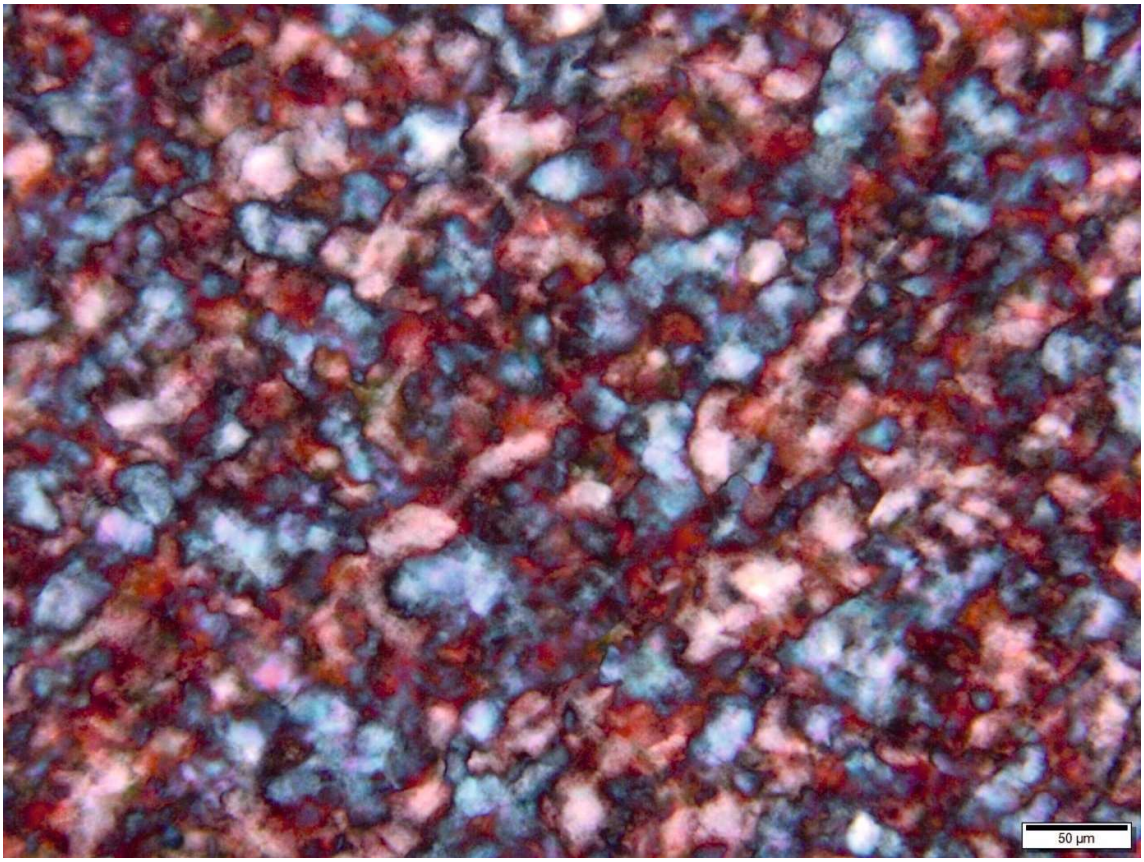

Figure S15. Polarized optical microscopy (POM) image of composite **C-1** prepared from organosilica precursor and CNC suspension. Image was captured between crossed polarizers using a 20x objective lens in transmittance mode. Scale bar is 50 µm. Original image included in ***Figure 4a*** in the manuscript.

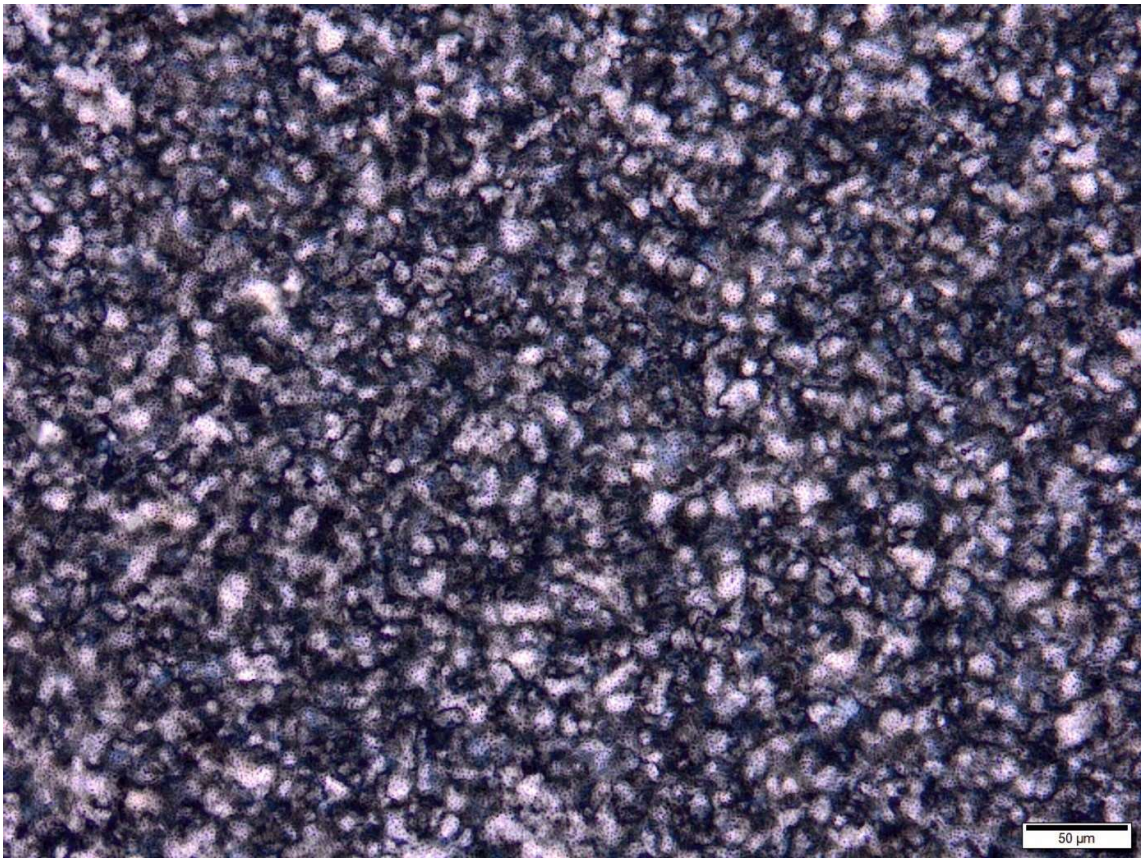

Figure S16. Polarized optical microscopy (POM) image of composite **C-3e** prepared from organosilica precursor, CNC suspension and sucrose. Image was captured between crossed polarizers using a 20x objective lens in transmittance mode. Scale bar is 50 µm. Original image included in ***Figure 4b*** in the manuscript.

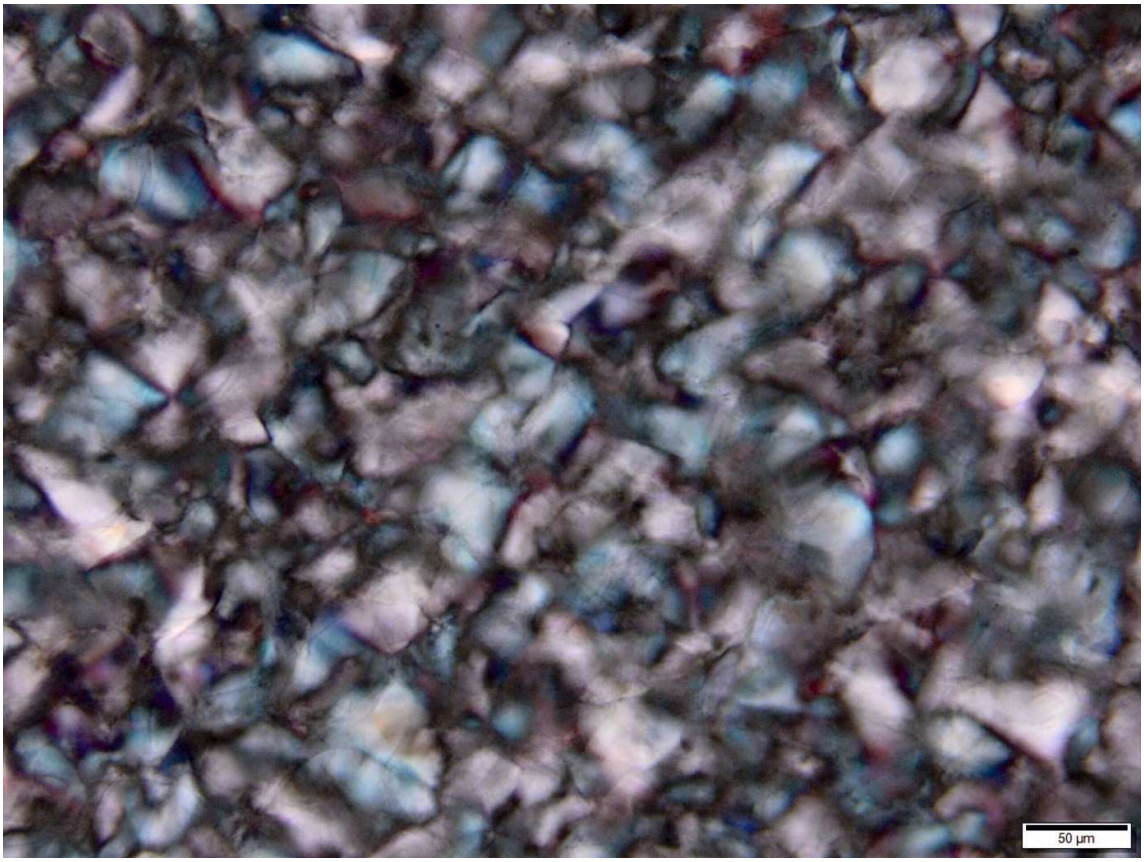

Figure S17. Polarized optical microscopy (POM) image of CNMO film prepared from organosilica precursor and CNC suspension (**Et-CNMO-1**). Image was captured between crossed polarizers using a 20x objective lens in transmittance mode. Scale bar is 50 µm. Original image included in ***Figure 4c*** in the manuscript.

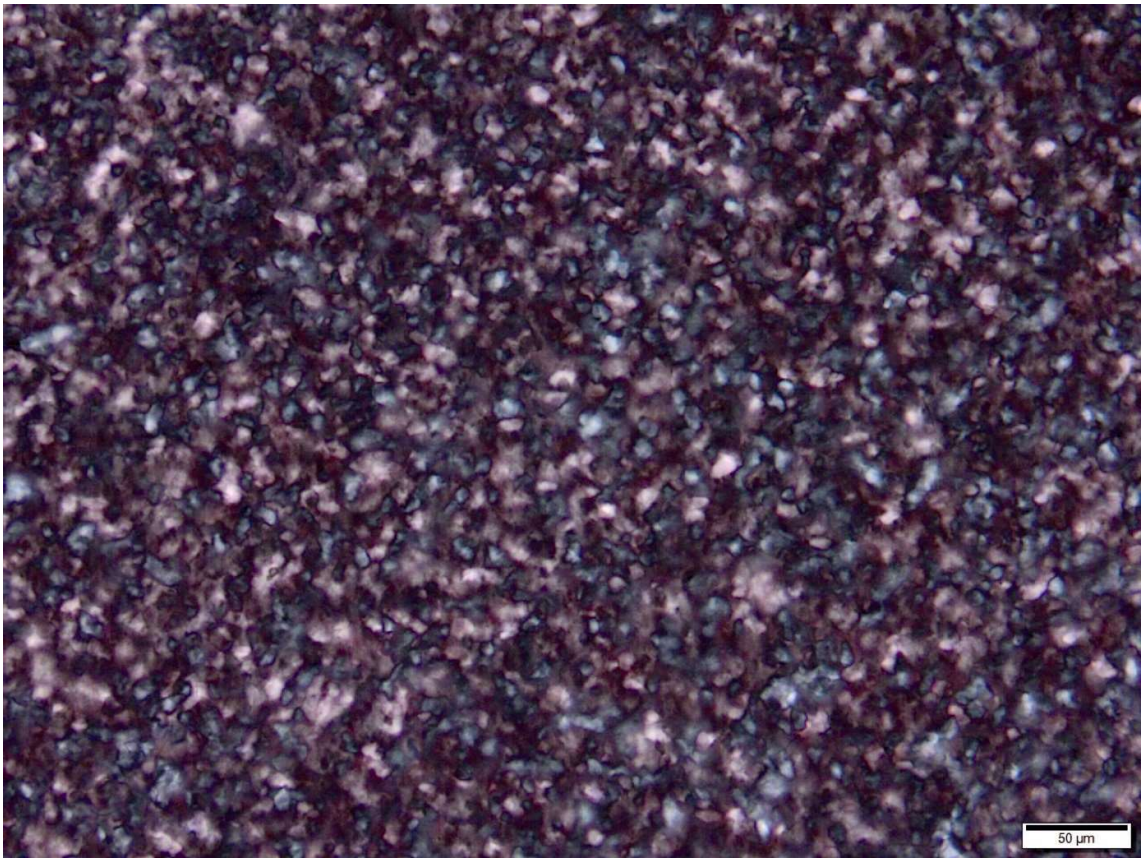

Figure S18. Polarized optical microscopy (POM) image of CNMO film prepared from organosilica precursor, CNC suspension and sucrose (**Et-CNMO-3e**). Image was captured between crossed polarizers using a 20x objective lens in transmittance mode. Scale bar is 50 µm. Original image included in ***Figure 4d*** in the manuscript.

SEM images

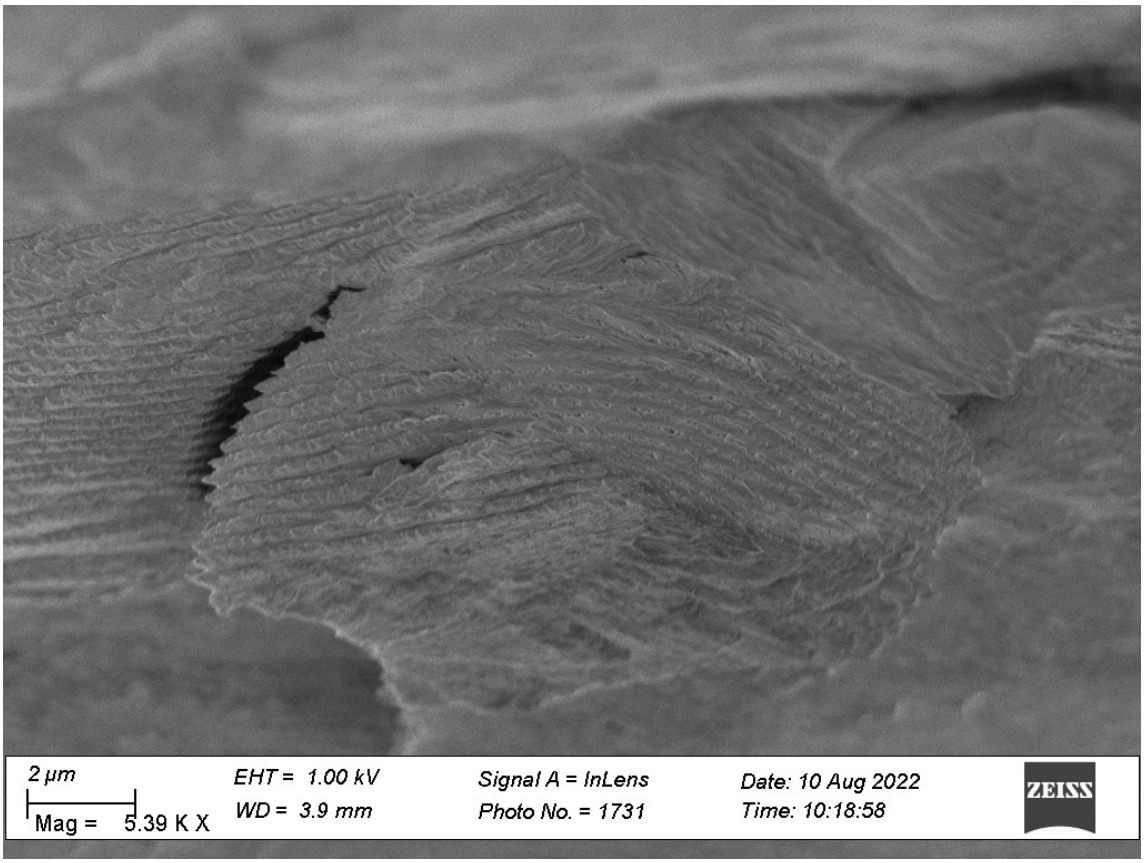

Figure S19. SEM image (cross section) of composites prepared from organosilica precursor and CNC suspension (**C-1**) – original image included in ***Figure 5a*** in the manuscript.

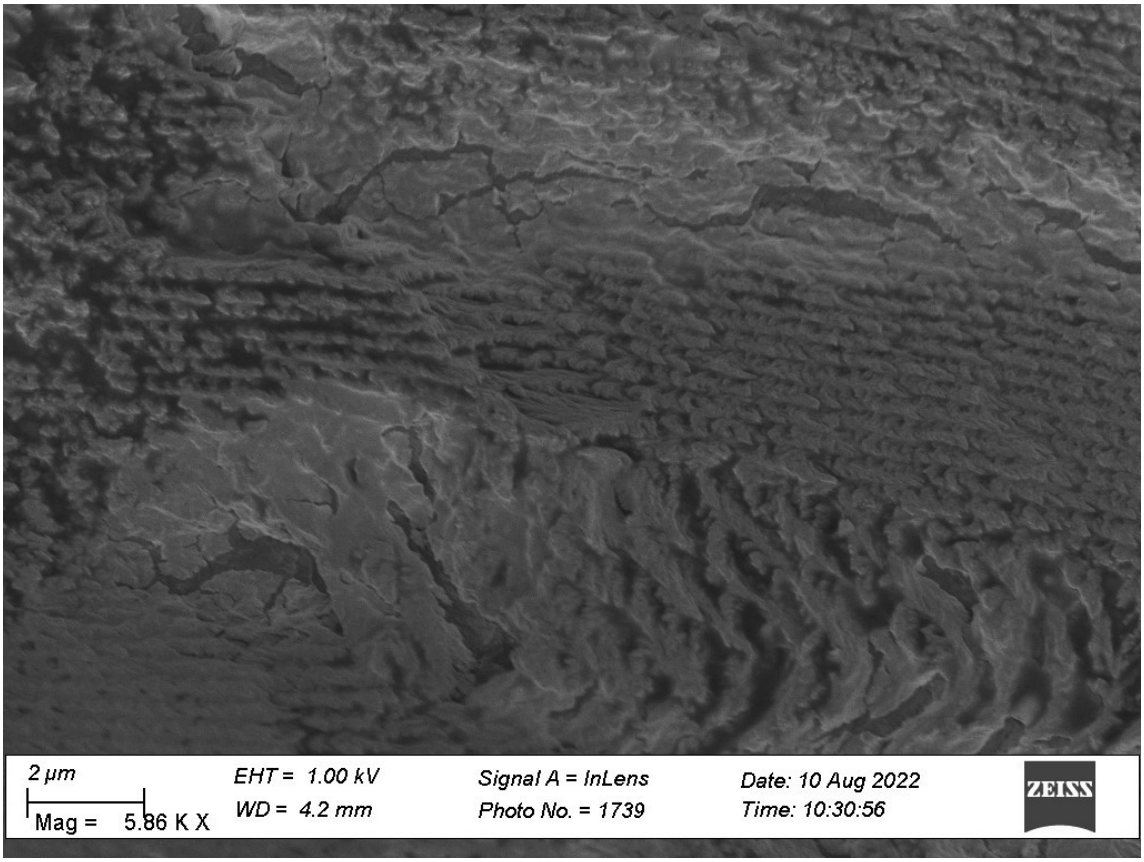

Figure S20. SEM image (cross section) of composites prepared from organosilica precursor, CNC suspension and glucose (**C-2e**) – original image included in ***Figure 5b*** in the manuscript.

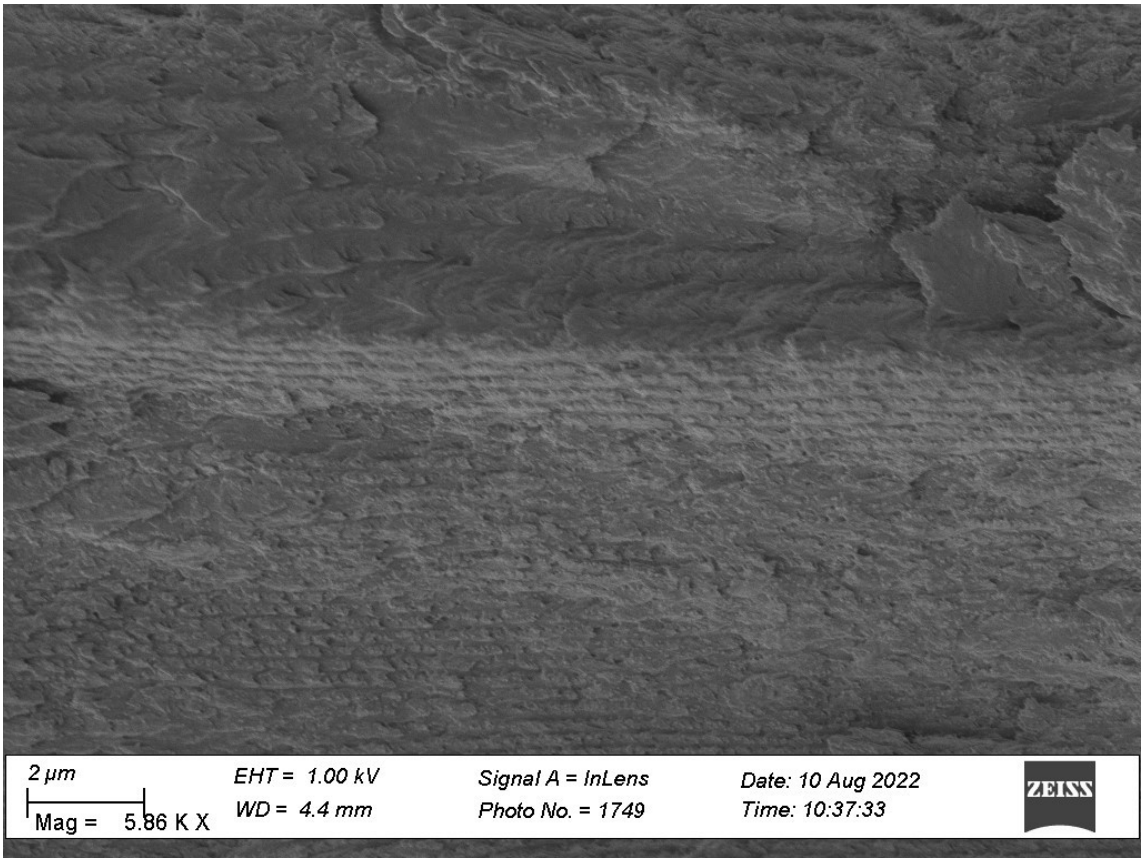

Figure S21. SEM image (cross section) of composites prepared from organosilica precursor and CNC suspension (**Et-CNMO-1**) – original image included in ***Figure 5c*** in the manuscript.

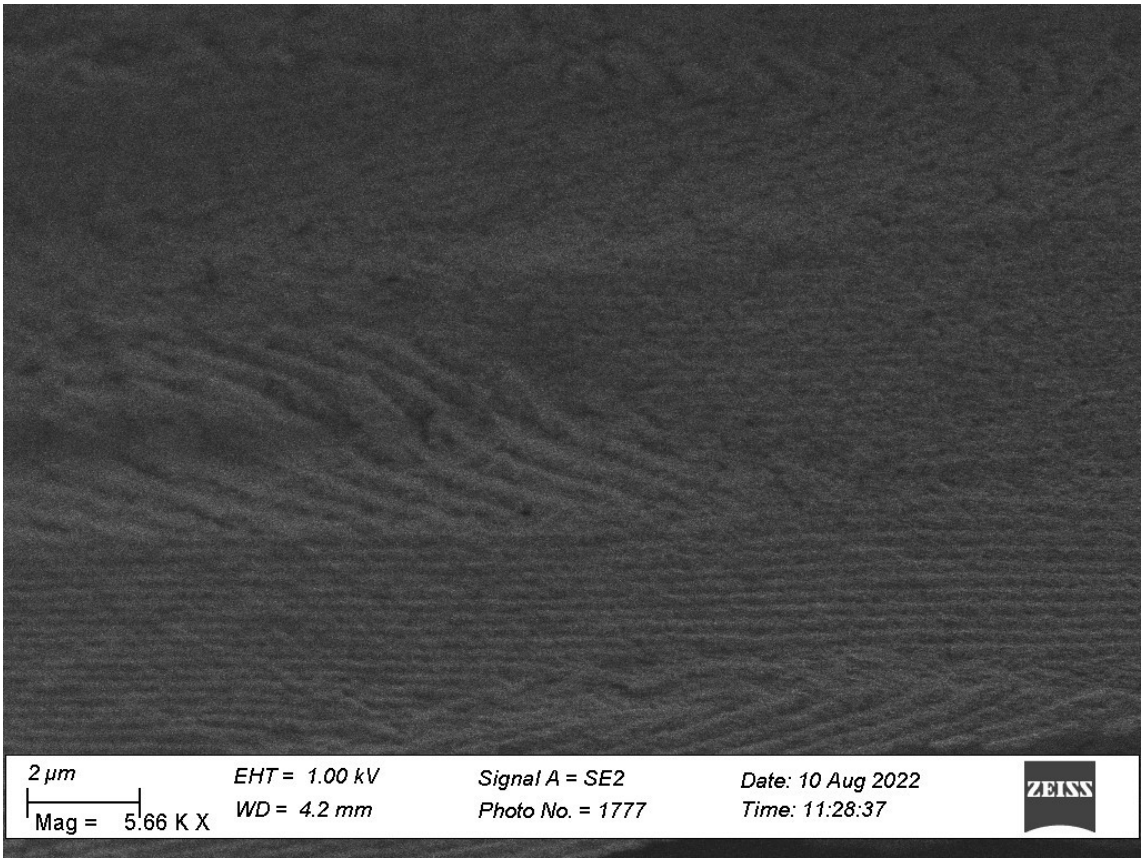

Figure S22. SEM image (cross section) of CNMO film prepared from organosilica precursor, CNC suspension and glucose (**Et-CNMO-2e**) – original image included in ***Figure 5d*** in the manuscript.