Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supplementary Information

Measuring Young's Modulus of Carboxylated Cellulose Nanocrystal Microbeads *via* Atomic Force Microscopy

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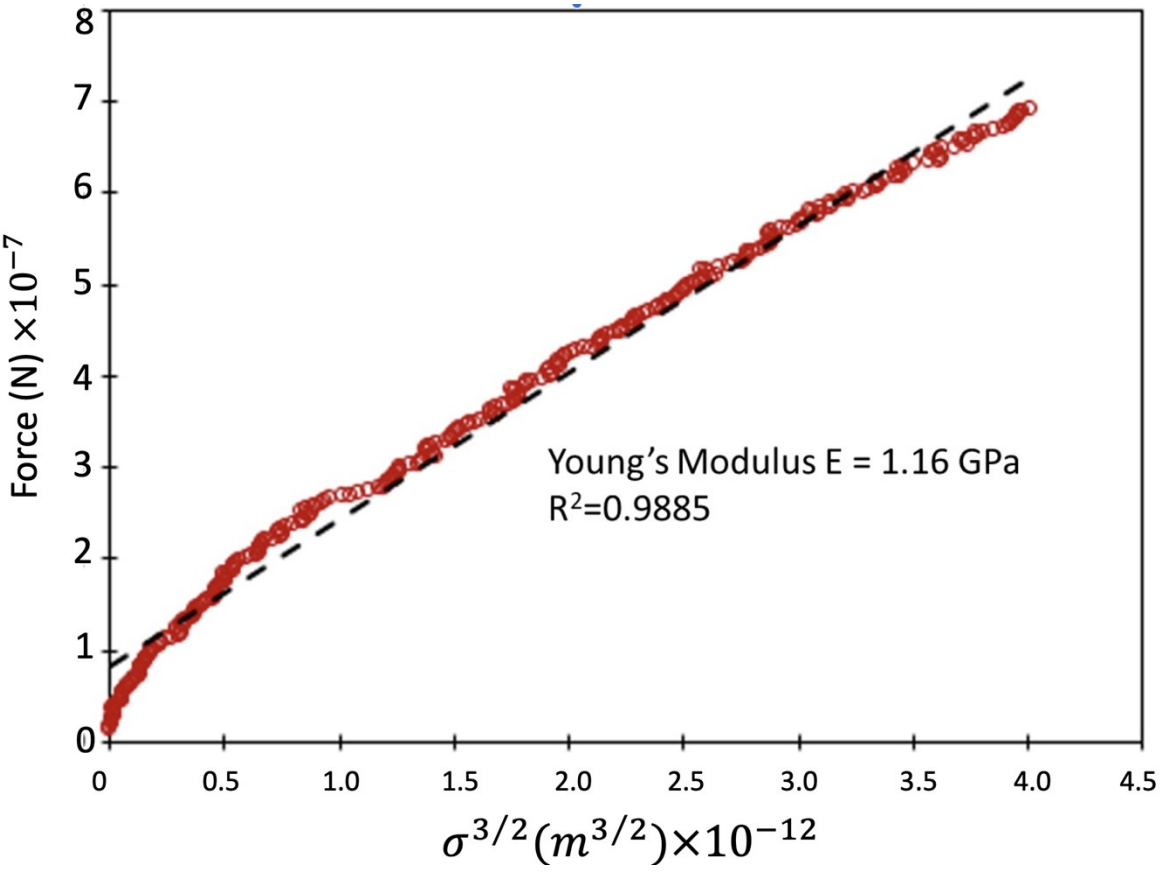

Figure ES1 Young's Modulus E of polystyrene microbeads based on a linear fit to the indentation depth expressed as $\delta^{3/2}$ for Hertz model.

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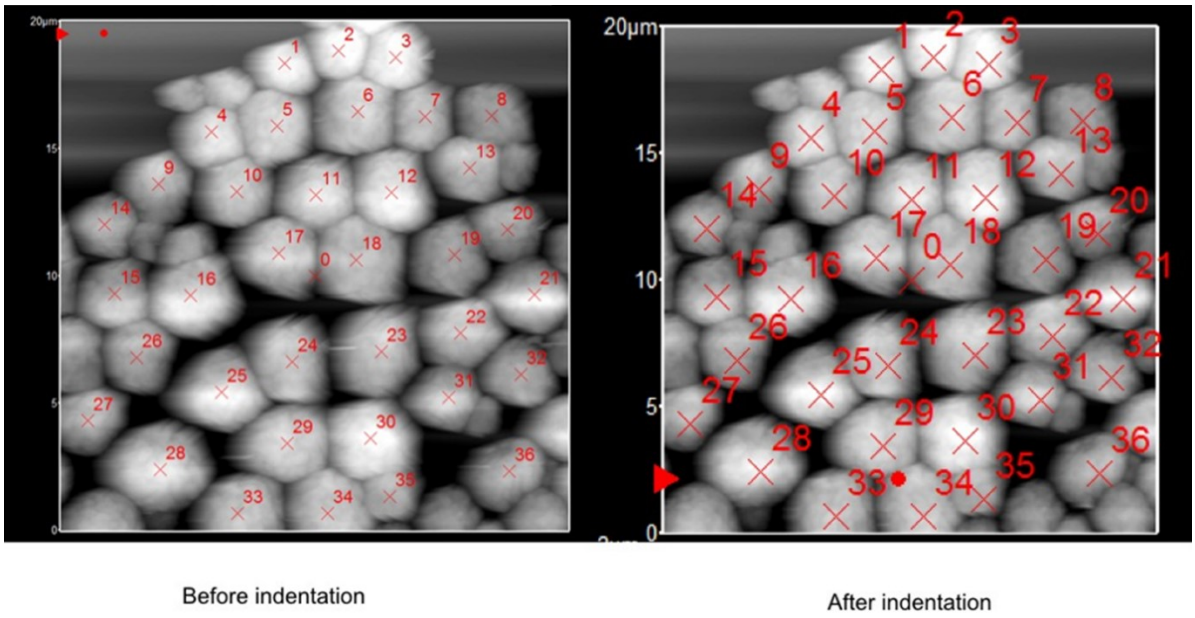

Figure ES2 cCNC microbead AFM topographic images before and after indentation.

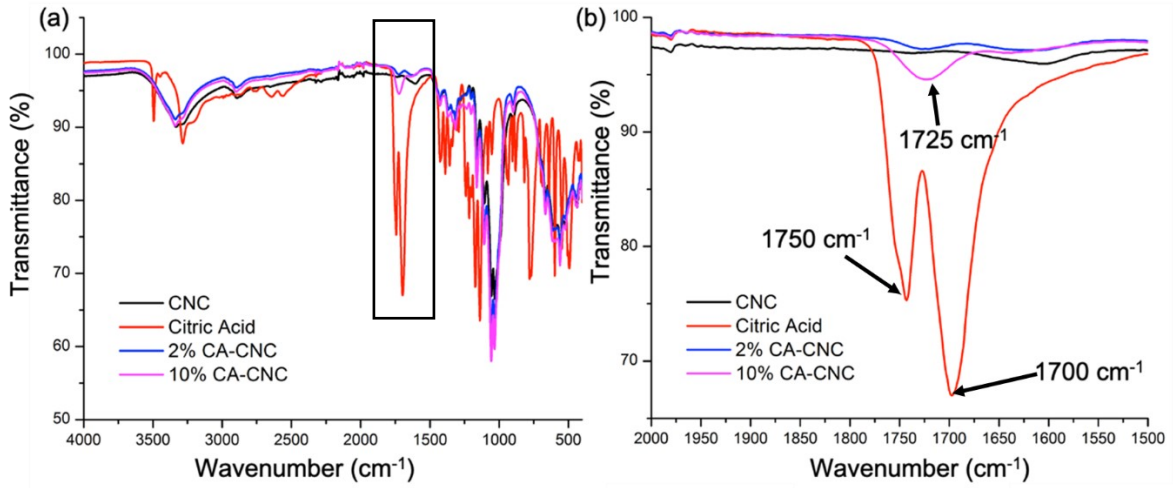

Figure ES3 ATR FT-IR spectra comparing cCNC microbeads, citric acid, 2% and 10% citric acid cCNC microbeads. (a) Overlapped full spectra of microbeads of cCNC, citric acid (CA) powder, and CA-cCNC microbeads. (b) Boxed region of spectrum (a) expanded. Region centered at 1725 cm^{-1} is the result of esterification of CA with cCNC. This region contains overlaps of ν (C=O) from unreacted carboxylic acid and ester. C=O stretching vibrations from neat citric acid powder are centred at 1700 and 1750 cm^{-1} .

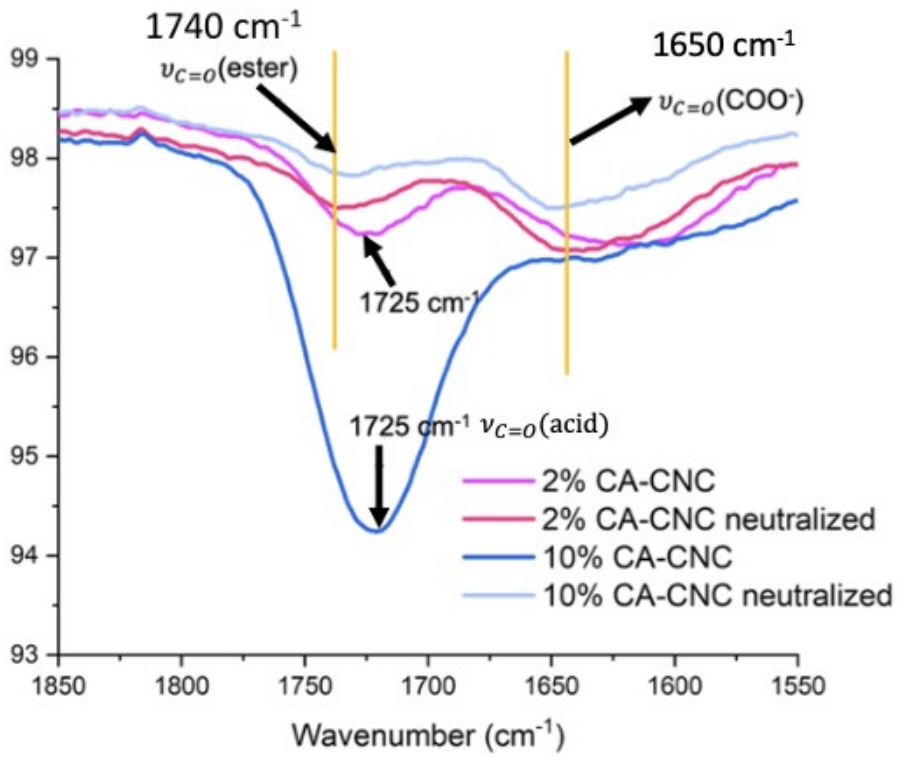

Figure ES4 ATR FT-IR spectra showing the ester bond carbonyl (~1740 cm^{-1}) for 2% and 10% CA-cCNC microbeads after immersing the microbeads in dilute aqueous base (pH=8) to shift carboxylic acid $\upsilon_{C=O}$ stretch from ~1700 cm^{-1} to sodium carboxylate at ~1650 cm^{-1}.

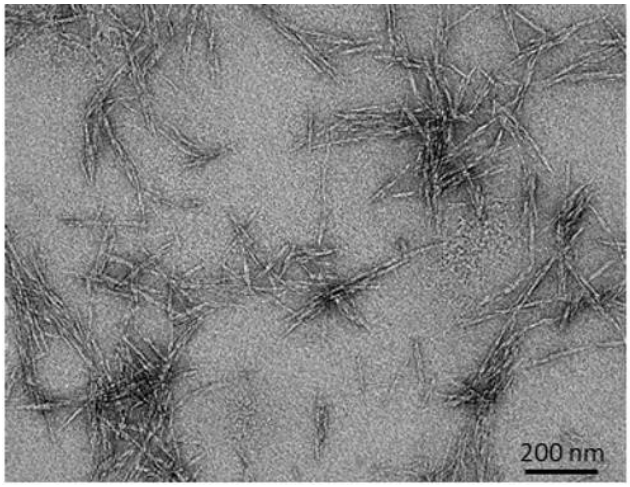

Figure ES5 TEM image of cCNC nanorods.