

Fabricating nanodiamonds from biomass by direct laser writing under ambient conditions

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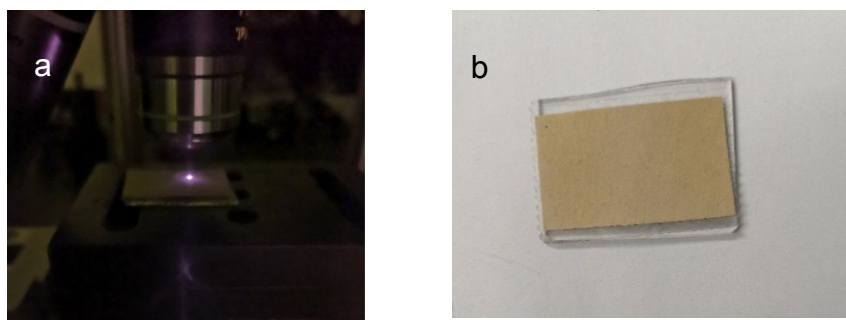


Figure S1. (a) Photograph of laser irradiating the CNF film; (b) the CNF film with paper substrate after laser irradiation.

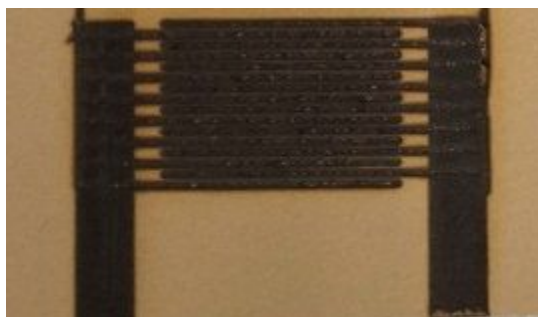


Figure S2. Photograph of a paper-based sensor from LCNF composites by femtosecond laser irradiation.

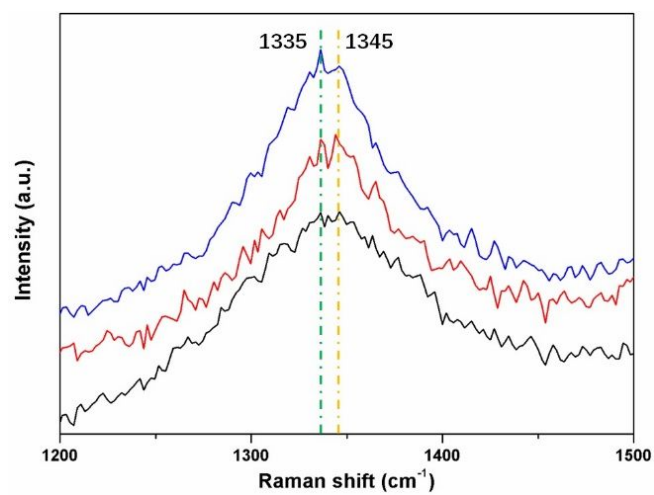


Figure S3. Raman spectra of P600S3.5 pattern.

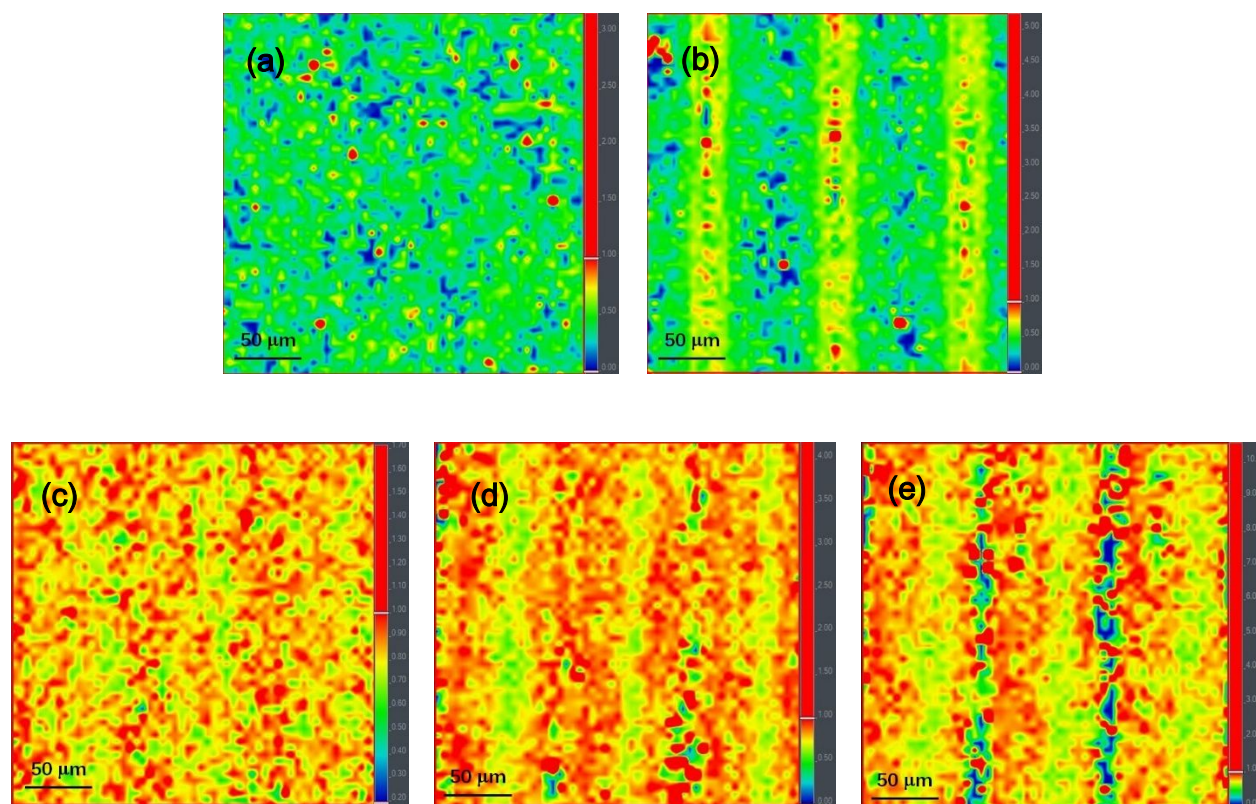
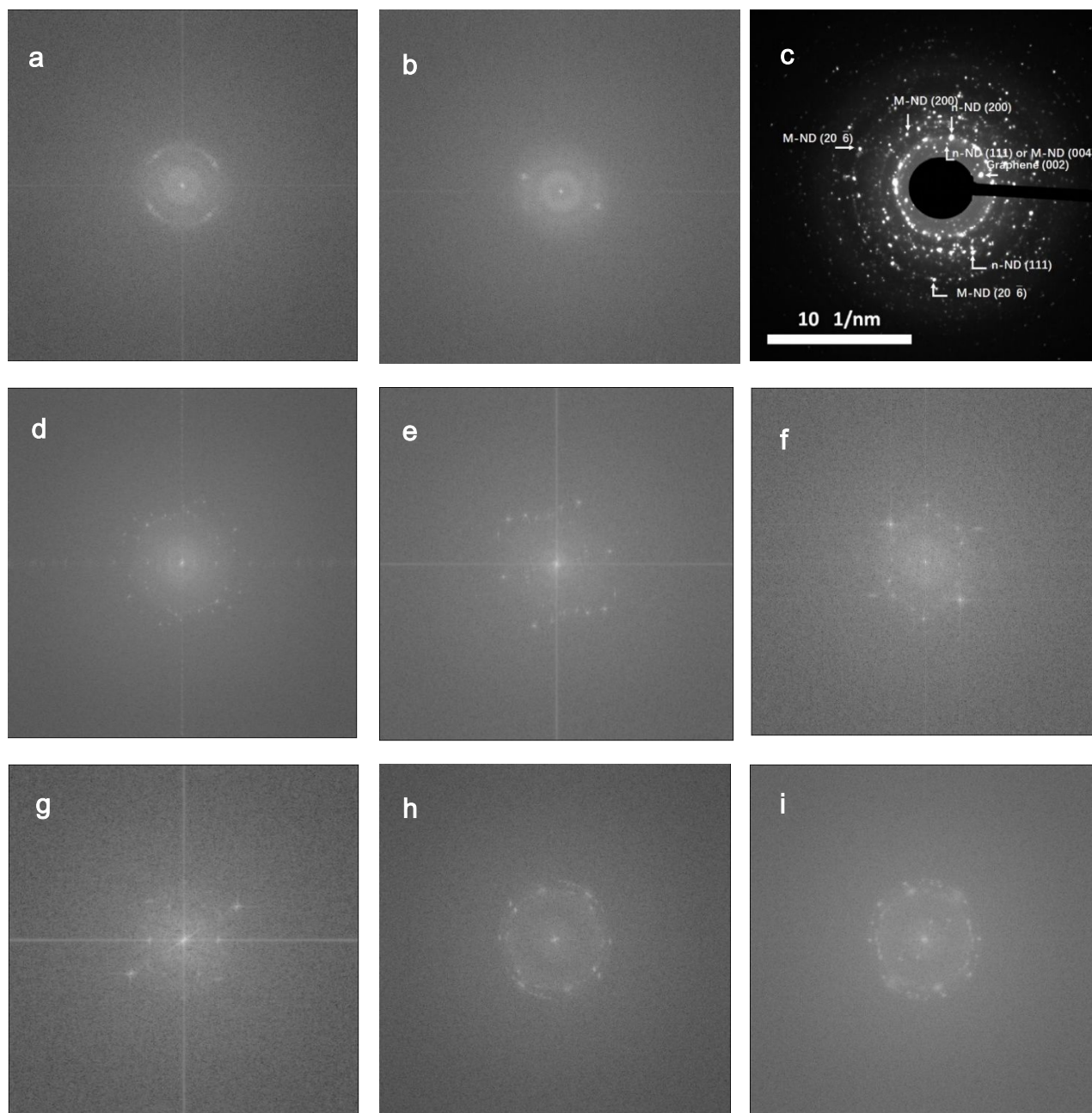


Figure S4. A selection of 2D Raman spectra mapping of I_D/I_G : (a) H-LCNF film; (b) P150S3.5 pattern; (c) P300S3.5 pattern; (d) P450S3.5 pattern; (e) P600S3.5 pattern.



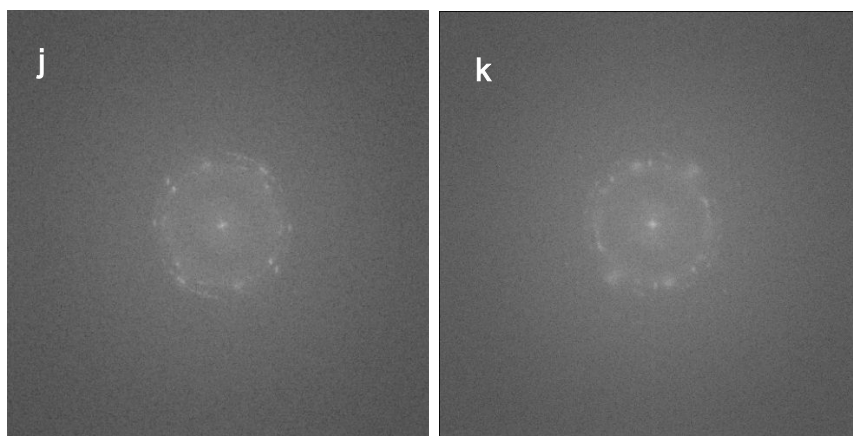


Figure S5. The Fast Fourier Transform (FFT) patterns: (a) the red part in **Figure 4a**; (b) **Figure 4b**; (d) upper left part in **Figure 4c**; (e) upper right part in **Figure 4c**; (f) lower left part in **Figure 4c**; (g) lower right part in **Figure 4c**; (h) **Figure 4e**; (i) **Figure 4f**; (j) **Figure 4g**; (k) **Figure 4h**. Image (c) was a typical SAED of NDs in P600S3.5 pattern.

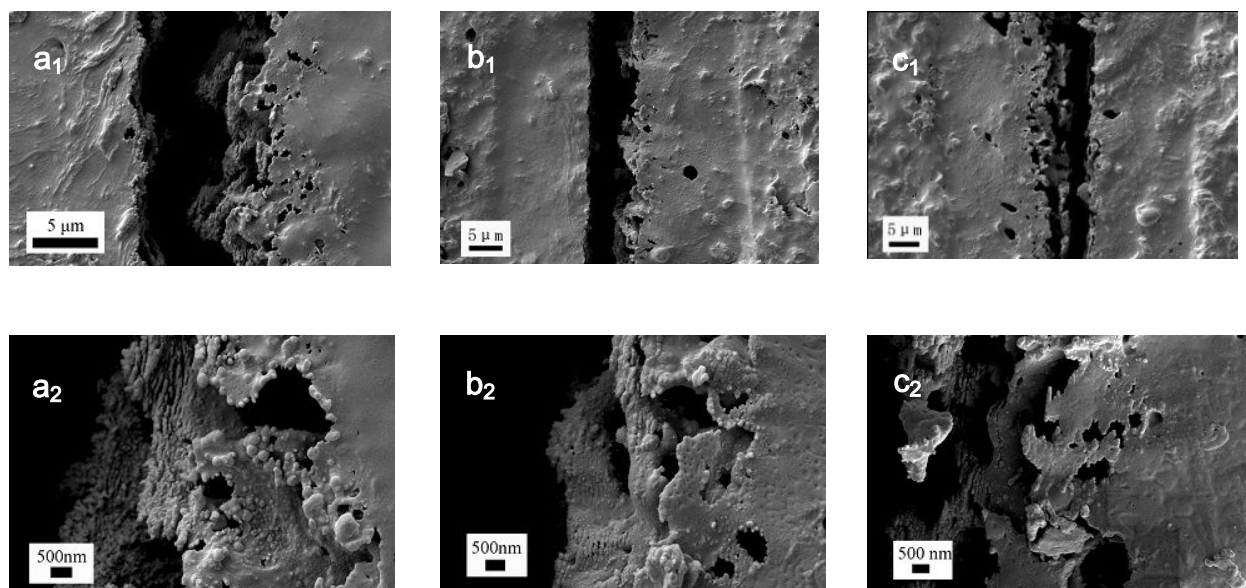


Figure S6. SEM images of laser-induced patterns at different laser writing speeds (H-LCNF film): (a) 1 mm/s; (b) 2.5 mm/s; (c) 3.5 mm/s.

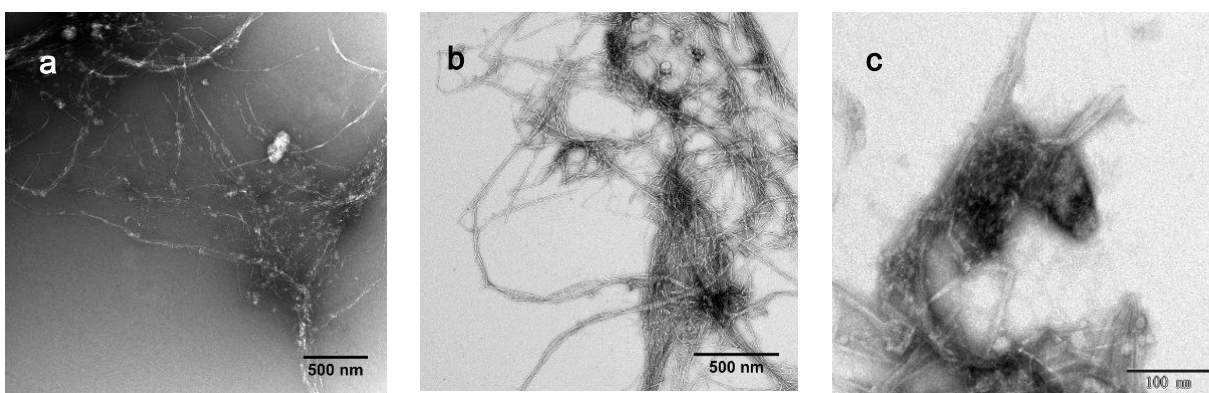


Figure S7. TEM images of LCNF: (a) L-LCNF; (b) M-LCNF; (c) W-LCNF.

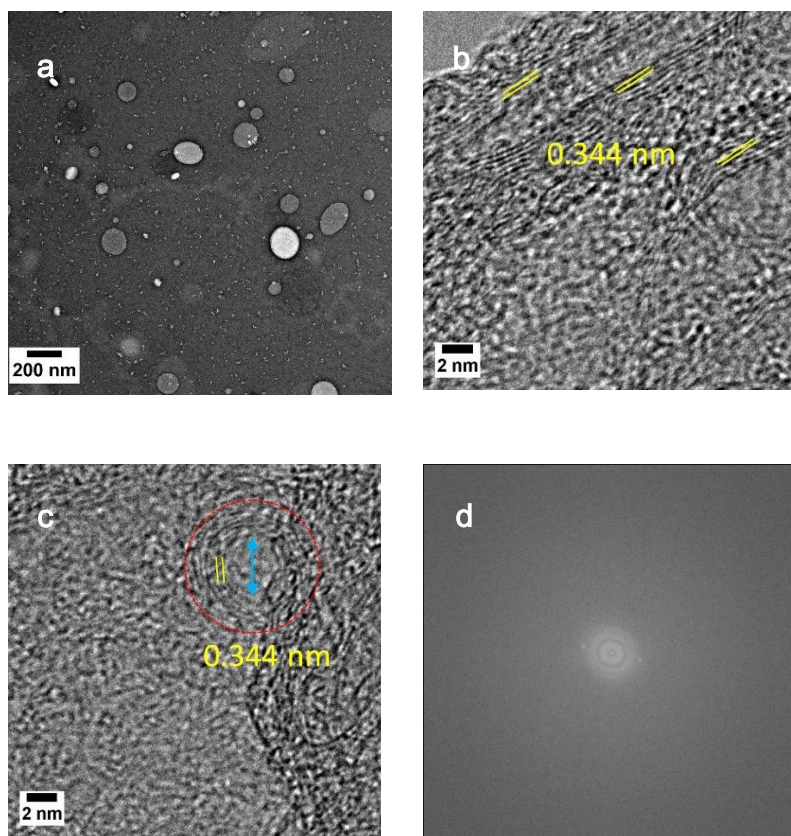


Figure S8. (a) TEM images of nano-lignin; (b-c) High-resolution TEM micrographs of laser-induced nano-lignin pattern in **Figure 8d**; (d) The Fast Fourier Transform (FFT) patterns of the selected parts in **Figure 8f**.

Table S1 Parameters of hydrothermal pretreatment and the main chemical compositions of switchgrass after pretreatment

Groups	Temperature/ °C	Time/ min	Cellulose content/ %	Hemicellulose content/ %	Lignin content/ %
Control	-	-	35.85	25.68	28.81
H-LCNF	200	60	46.19	2.48	36.67
M-LCNF	180	90	47.83	2.83	30.54
L-LCNF	180	30	50.74	1.96	26.70
W-LCNF	120	60	32.91	19.33	28.66

Table S2 Comparison of d-spacings of laser-induced NDs (LI-ND) with some reported NDs

Type of ND	LI-ND	MW-ND ¹	M-ND ²	n-ND ³	n-ND ⁴	h-ND ^{1, 5}	ND ⁶
	(this study)						
d-spacings	0.315	0.319	0.312	0.315			
in nm			(004)	(111)			
	0.272-0.273	0.266-0.272		0.273			
				(200)			
	0.254					0.253	
						(110)	
	0.230						0.230
	0.217	0.218-0.226	0.217			0.218	
			(200)			(100)	
	0.208-0.209	0.209			0.206-0.209	0.206	
					(111)	(002)	
	0.154	0.153	0.151			0.150	
			(20 $\bar{6}$)			(102)	

Table S3 Square resistance of laser-induced patterns

Groups	P150S3.5	P300S3.5	P450S3.5	P600S3.5	NL-900
Square resistance/(k Ω /□)	65.41	18.01	1.33	11.17	0.51

References

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