Supporting Information

Aerosol-jet-Printed Preferentially aligned Carbon Nanotube Twin-lines for Printed Electronics

Guo Liang Goh^{1, a}, Shweta Agarwala^{2, b}, and Wai Yee Yeong^{1, c*}

Guo Liang Goh, Prof. Wai Yee Yeong ¹Singapore Center for 3D Printing, School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore E-mail: <u>WYYEONG@ntu.edu.sg</u>

Prof. Shweta Agarwala ²Department of Engineering, Aarhus University, 8200 Aarhus N, Denmark



Figure S1. (a) FESEM micrograph of the dispersed CNT on polyimide substrate, (b) Histogram showing CNT length distribution of the Nanolab SWNT ink, (c) Image sequence showing the pinned contact evaporation mode of 0.2 μ L of the SWNT ink drop, where T_e represents total evaporation time.

		+ + + + + + + + + + + + + + + + + + +
	Length	and the second
Number	(um)	
1	14.05	
2	15.895	The second second second
3	19.626	
4	15.895	
5	15.421	
6	16.848	and the second sec
7	16.822	100 0000
Average	16.36529	100.0000μm
STD	1.593219	

Figure S2. Optical image showing the minimum line width of CNT twin line obtainable by aerosol jet printing process. Inset shows the measurement of the line widths. (NS: $150 \mu m$, SH: 100 sccm, UA: 30 sccm, SP: 1mm/s, ST: 25 °C)



Figure S3. SEM image showing overspray effect. The bright shade in the image is the CNT, whereas the dark shade is the substrate.



Figure S4. (a) Enlarged image of figure 4b in the manuscript, (b & c) CNT alignment analysis showing the angular distribution of CNT for different samples. Both samples show preferentially aligned CNT at the contact lines.

Summary of Data						
	Treatments					
	1	2	3	4	5	Total
Ν	14	13	10	13		50
ΣX	5.7133	7.1552	5.9593	7.6613		26.489
Mean	0.4081	0.5504	0.5959	0.5893		0.53
ΣX ²	3.1012	3.9668	3.562	4.559		15.189
Std.Dev.	0.2433	0.0488	0.0345	0.0605		0.1536
	Result Details					
Source	SS	df	MS			
Between- treatments	0.3027	3	0.1009	<i>F</i> = 5.44143		
Within- treatments	0.853	46	0.0185			
Total	1.1557	49				

Table S1. Anova test to analyse the effect of atomizer flow on Herman's orientation factor

The *f*-ratio value is 5.44143. The *p*-value is .00275. The result is significant at p < .05.

	Treatments					
	1.00	2.00	3.00	4.00	5.00	Total
Ν	13.00	17.00	20.00			50.00
ΣX	7.66	9.81	9.60			27.07
Mean	0.59	0.58	0.48			0.54
$\sum X^2$	4.56	5.78	4.99			15.33
Std.Dev.	0.06	0.09	0.14			0.12

Table S2. Anova test to analyse the effect of sheath flow on Herman's orientation factor

Result Details

Source	SS	df	MS	
Between- treatments	0.13	2.00	0.06	F = 5.46574
Within- treatments	0.54	47.00	0.01	
Total	0.67	49.00		

The *f*-ratio value is 5.46574. The *p*value is .007342. The result is significant at p < .05.