SUPPORTING INFORMATION

Additive Manufacturing Technologies Compared: Morphology of Deposits of Silver Ink Using Inkjet and Aerosol Jet Printing

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Author Contributions

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A.1 Comparison of IJP and AJP based on system specification

Table S1: Comparison of Dimatix DMP-3000 and Optomec Aerosol Jet AJ 300 CE

	Dimatix DMP 3000	**Optomec AJ 300CE**
		
Axis Motion speed in $mm \cdot s^{-1}$	max. 490	max. 200
System positional accuracy in µm	± 5	± 6
Image transfer, processing	Raster-based	Vector-based
Printable area in mm^2	300 x 300	300 x 300
Deposition principle	Drop-on-demand piezo inkjet	Continuous aerosol mist
Nozzle orifice in µm	9-42, used 21.5	100-300, used 200
Number of nozzles	1…128 (synchronous), used: 16 nozzles development head – only one nozzle was employed	2 (asynchronous) – only one was employed
Droplet volume range in pL	1…35, used 10 nominal	5.2×10^{-4}…6.5×10^{-2}
Ink viscosity range in cP	2…30	0.7…1000

A.2 Measurement droplet diameter and splat widths

Fig. S1 shows the measuring procedure for the droplet diameter. The radii of the droplets were measured with the three point measurement method of the image processing software of the NIKON Eclipse L200N microscope. This measurement procedure was chosen due to the high circularity of the droplets.

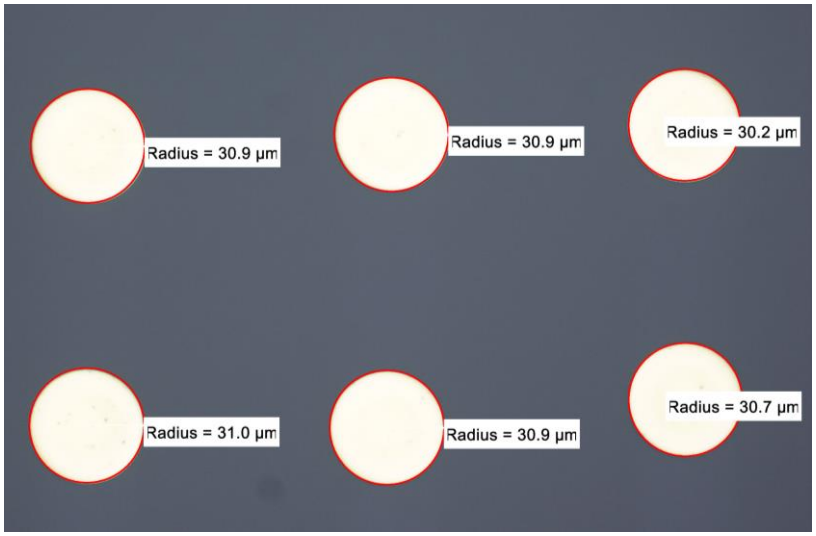

Figure S1: Measurement of droplet diameter in IJP: Determination of the radii of the printed droplets using the three point method of the microscopic image processing software

The splats printed with AJP do not have a high circularity as the droplets printed with IJP. Moreover, the shutter movement strongly influences the final shape of the printed splat. Therefore, three measurement points were defined to characterize the printed splats: (i) horizontal splat width w_{Spx}, (ii) vertical splat width w_{Spy},(iii) and enhanced vertical splat width $w_{Sp\ yL}$ including most of the deposited material. Fig. S2 shows the defined measurement points exemplary.

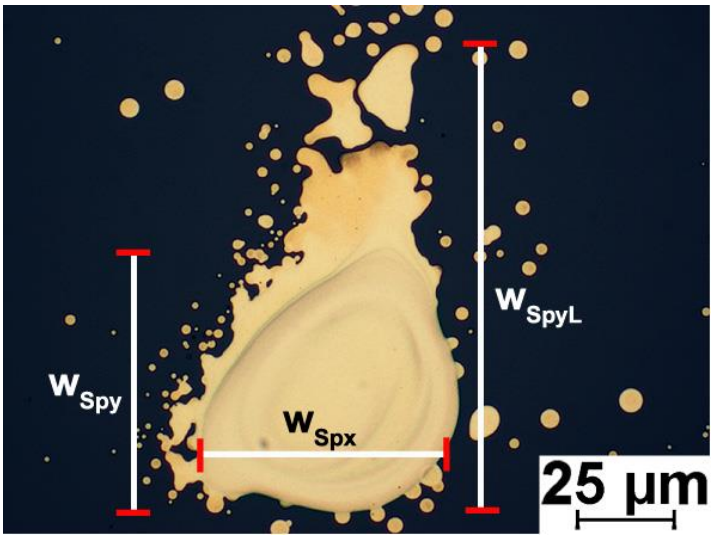

Figure S2: Measurement of splat widths in AJP: Definition of three measurement points of a printed splat to gather the main characteristics

A.3 Measurement of line width and height

The measurement of line width and line peak heights were performed with the VEECO Dektak 150 profilometer. Every line printed with IJP and AJP was investigated by scanning its cross sectional profile three times in total at randomly chosen positions of the line. From these three values the average and the standard deviation was calculated. Because lines printed with AJP have clusters of small splats and sprinkles, a special area of interest was defined from which the considered parameters were determined. Fig. S3 B shows the area of interest (colored green). As indicated, sprinkles and clusters of splats were excluded.

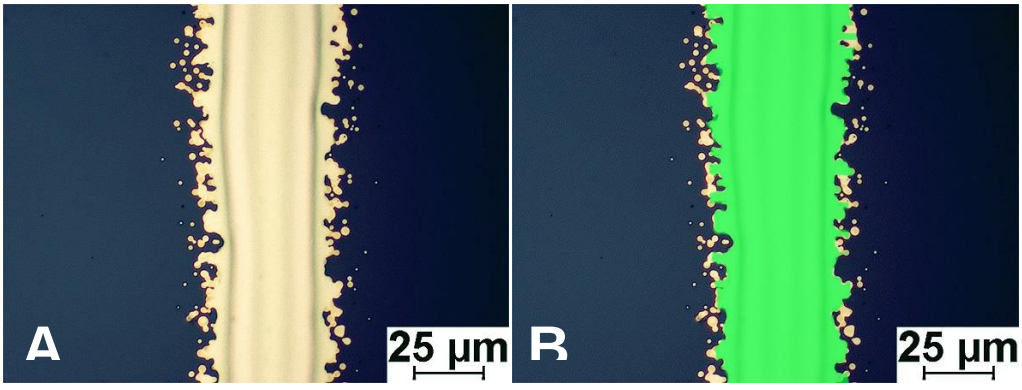

Figure S3: Definition of area of interest for the line width and peak height measurement, A) original microscopic image and B) defined area of interest excluding some sprinkles and splats (colored green)

A.4 Line morphology in IJP

An overview of line patterns as a function of drop distance (printed IPD) is shown in Fig. A5. It is obvious that the width of the printed lines increases with decreasing drop distance.

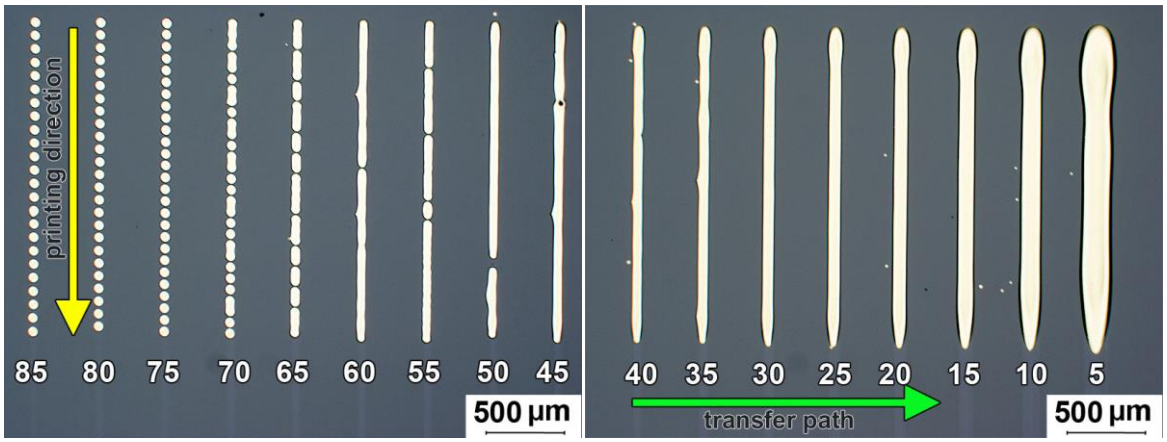

Figure S4: Line morphologies as a function of drop distance IPD

In contrast to Fig. A5, the lines of Fig. A6 were printed CPD. Again, the drop distance was varied. As visible, the line morphology is different to the lines deposited IPD, e.g. there is no remarkable variation of line width. For all drop distances tested, the width of the printed lines do not change significantly.

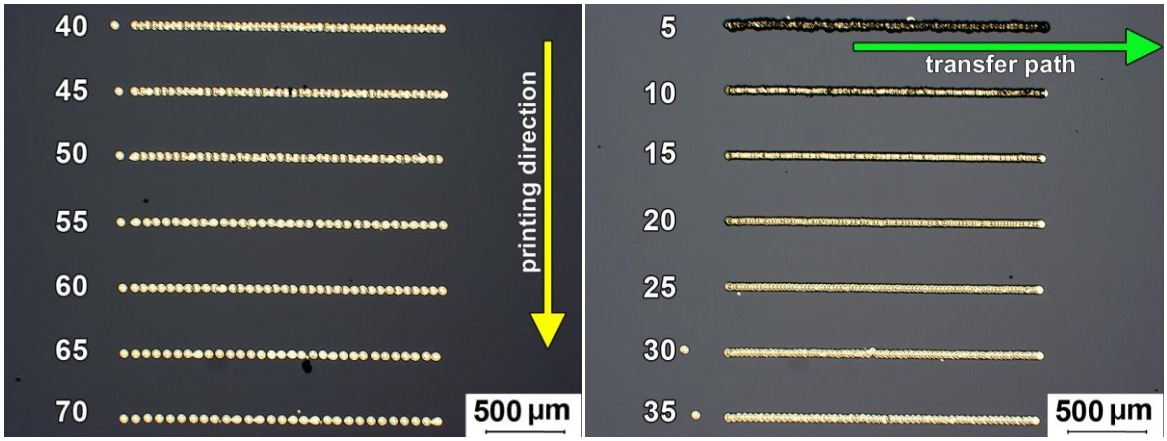

Figure S5: Line morphologies as a function of drop distance CPD

A.5 Achievable ranges of line width and line peak height using IJP and AJP

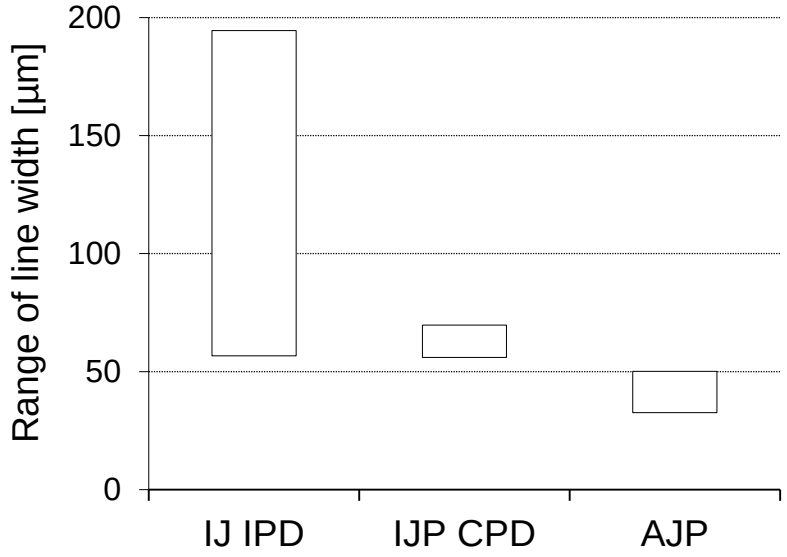

Figure S6: Range of line width achievable with IJP (IPD and CPD) and AJP

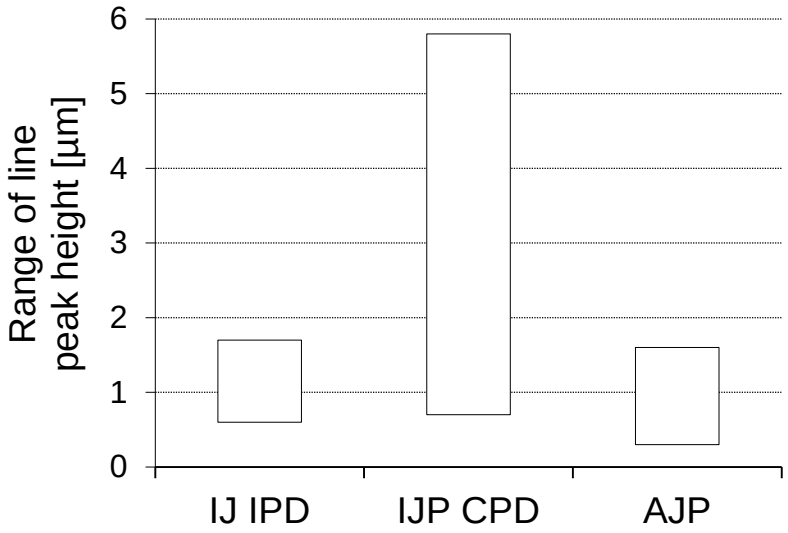

Figure S7: Range of line peak heights achievable with IJP (IPD and CPD) and AJP