Supporting Information for theoretical evaluation of the melting efficiency for the single-screw micro-extrusion process: the case of 3D printing of ABS

Standard Extruder II

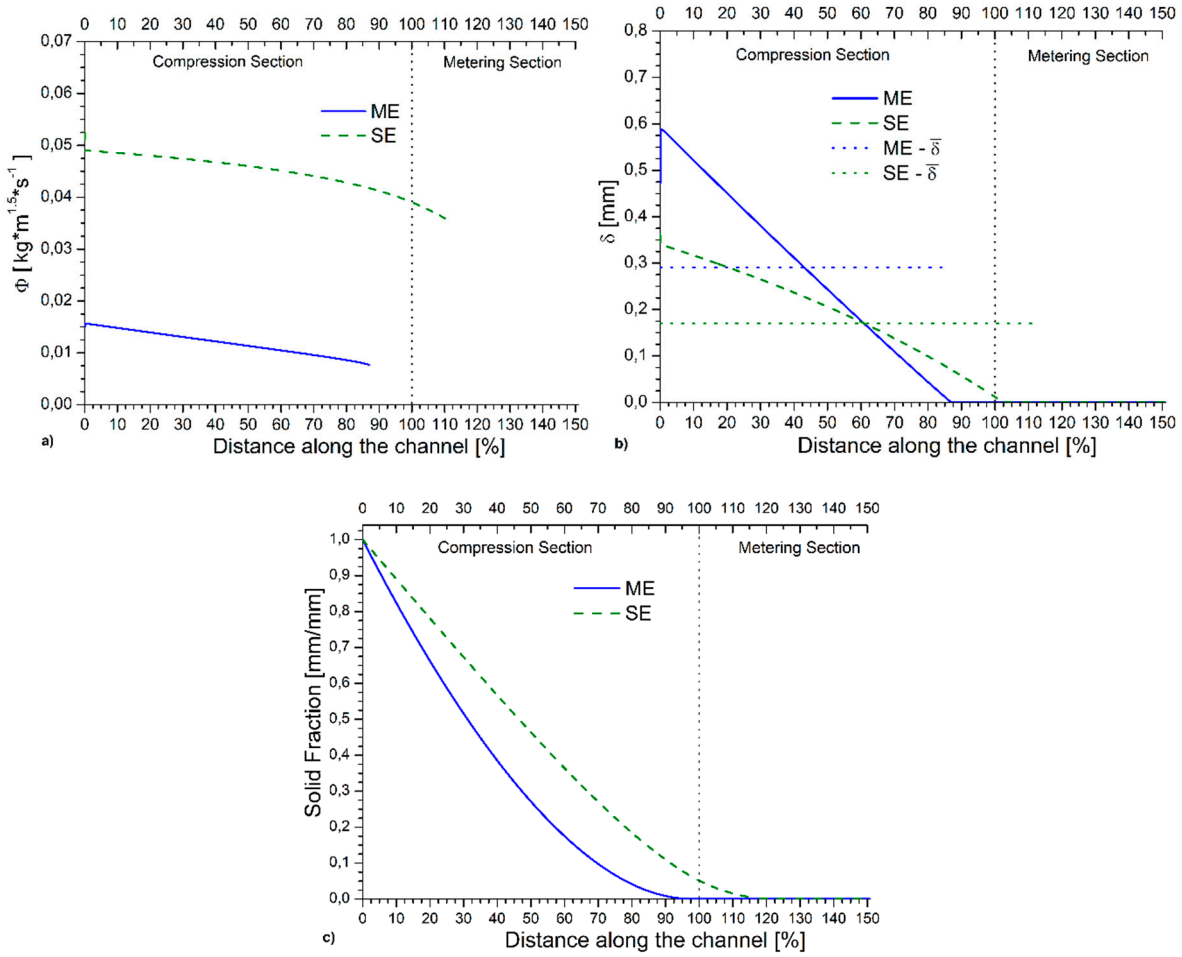


Figure S1. Extra information for Figure 6 in the main text regarding (a) melting efficiency parameter ϕ; (b) melt film layer thickness δ; (c) solid bed profile; in (b) also the overall average melt layer thickness ($\bar{\delta}$) is provided as horizontal lines.

Compression ratio

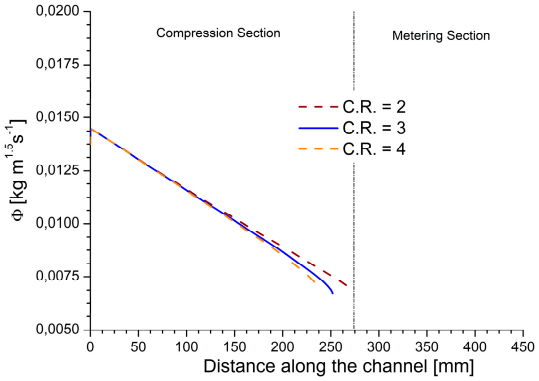


Figure S2. Variation of melting efficiency parameter ϕ as extra information for Figure 9.

Pitch Angle

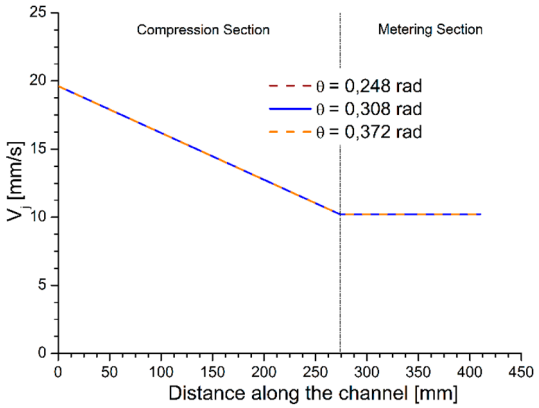


Figure S3. Relative velocity for different values of the pitch angle; extra for Figure 10 in the main text

Volumetric Inlet:

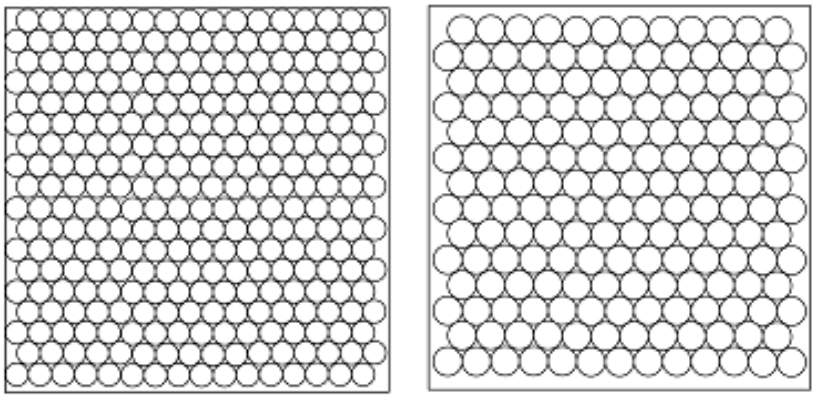
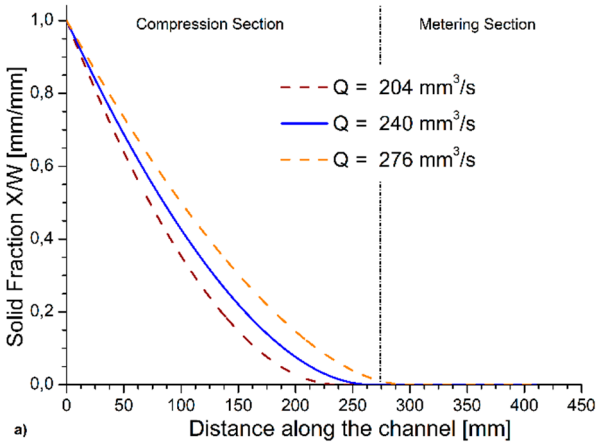
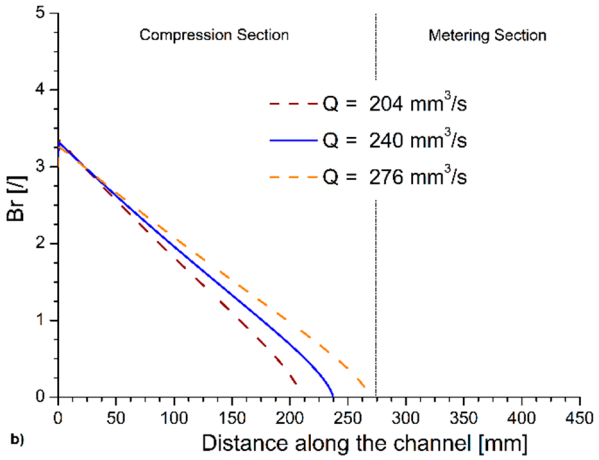


Figure S4. Difference in the polymer (pellets) to channel volume ratio going from 2.4 mm (left, 81% filled) to 3 mm radius (right 74% filled).


Compression Section
Metering Section
Q = 204 mm³/s
Q = 240 mm³/s
Q = 276 mm³/s
Solid Fraction X/W [mm/mm]
1,0
0,8
0,6
0,4
0,2
0,0
0
50
100
150
200
250
300
350
400
450
Distance along the channel [mm]

a)


Compression Section
Metering Section
Q = 204 mm³/s
Q = 240 mm³/s
Q = 276 mm³/s
Br [/]
5
4
3
2
1
0
0
50
100
150
200
250
300
350
400
450
Distance along the channel [mm]

b)

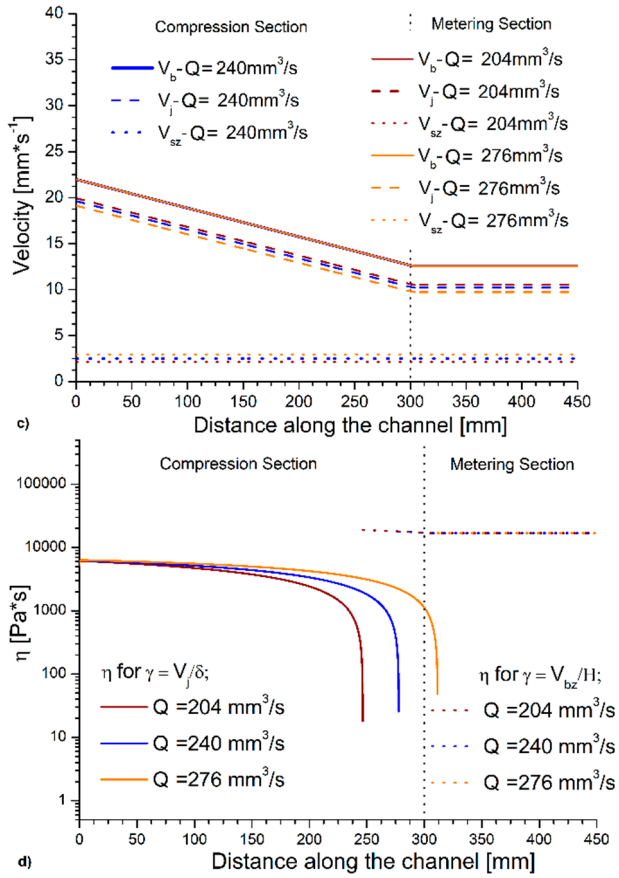


Figure S5. a) Melting profile for different volumetric inlets; b) Brinkman number for different volumetric inlets. Other parameters, as in Tables 1 and 2; c) Associated velocity variations; d) associated viscosity variation; Blue lines are reference lines

Channel Width

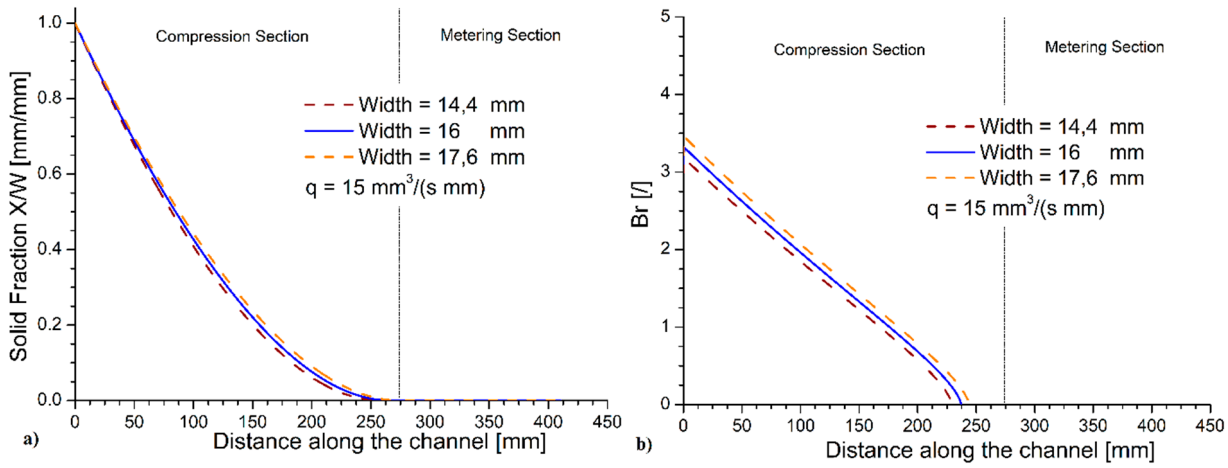


Figure S6. a) Melting profile for different values of the channel width; b) Brinkman number for different values of the channel width; Other parameters as in Tables 1 and 2.

Thermal conductivity

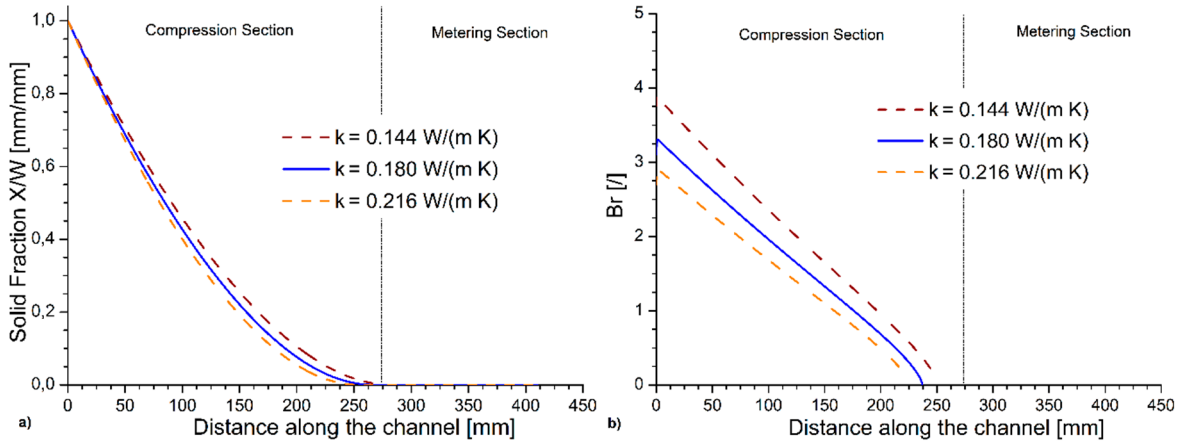


Figure S7. a) Melting profile for different values of the thermal conductivity; b) Brinkman number for different values of the thermal conductivity; Other parameters as in Table 1 and 2; blue line reference case.

Power law

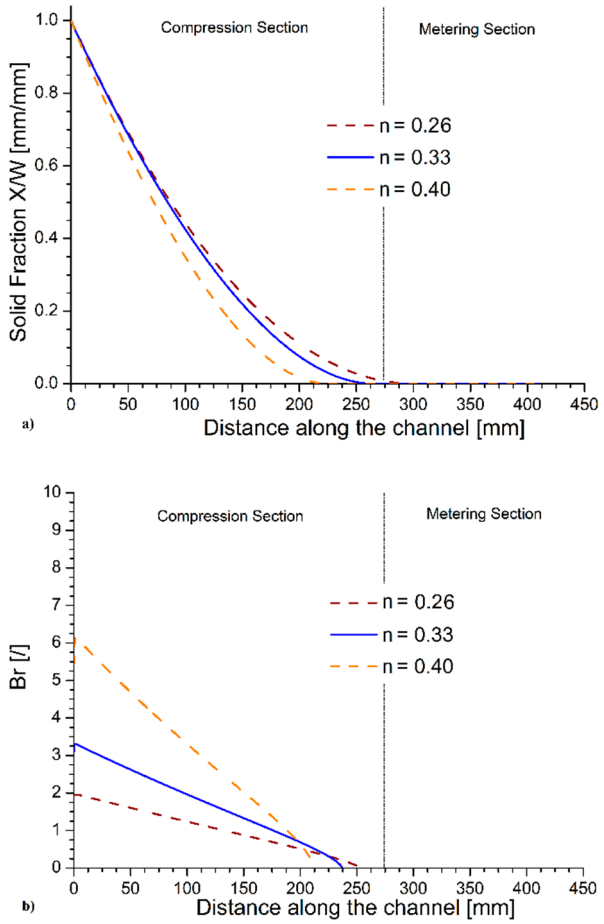


Figure S8. a) Melting profile for different Power-law indices; b) Brinkman number for different Power-law indices; Other parameters as in Tables 1 and 2; blue lines are reference case