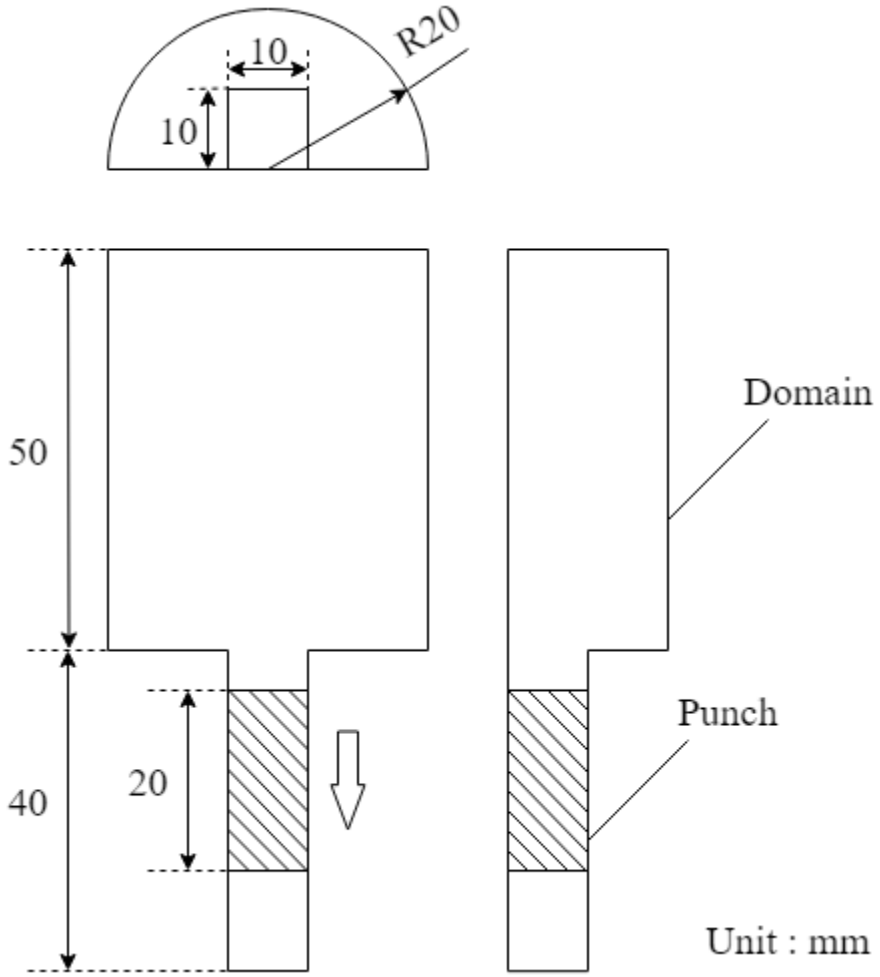


Figure 1. Schematic diagram

Table 1. Physical properties

Gas phase	
Viscosity	1.8×10^{-5} Pa・s
Density	1 kg/m^3
Solid phase	
Density	1500 kg/m^3
Spring constant	50 N/m
Coefficient of restitution	0.9
Coefficient of friction	0.3

Table 2. Calculation conditions

Particle diameter	250 μm
Number of particles	500,000
Grid size	0.5 mm
Calculation time	0.24 s

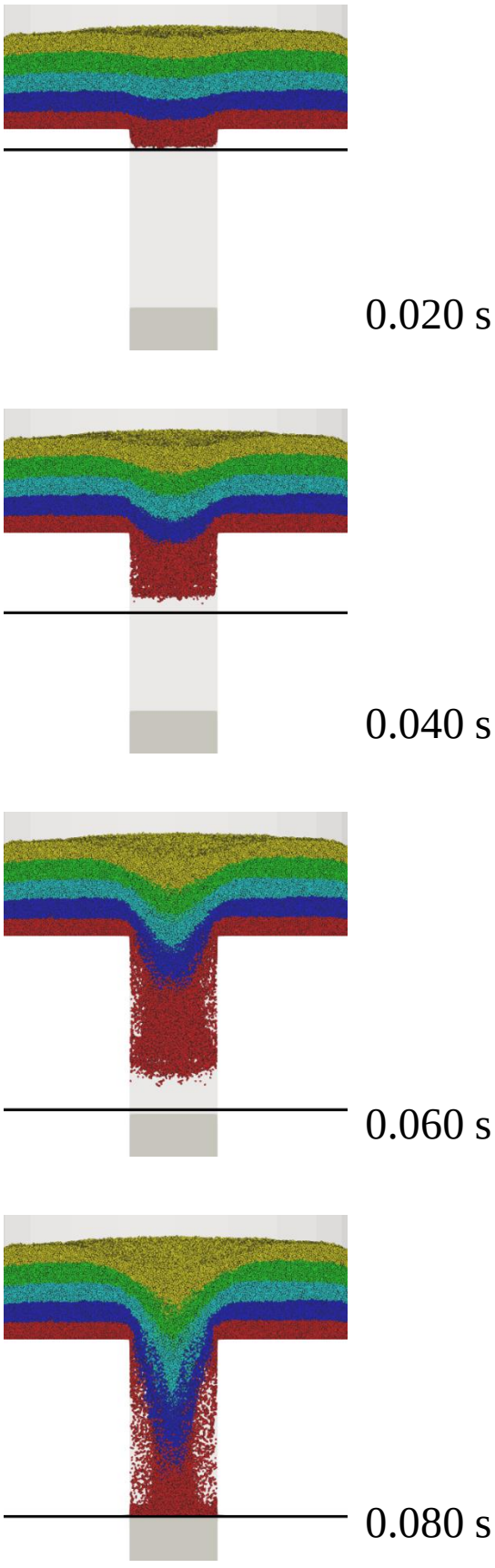


Figure 2. Particle distribution

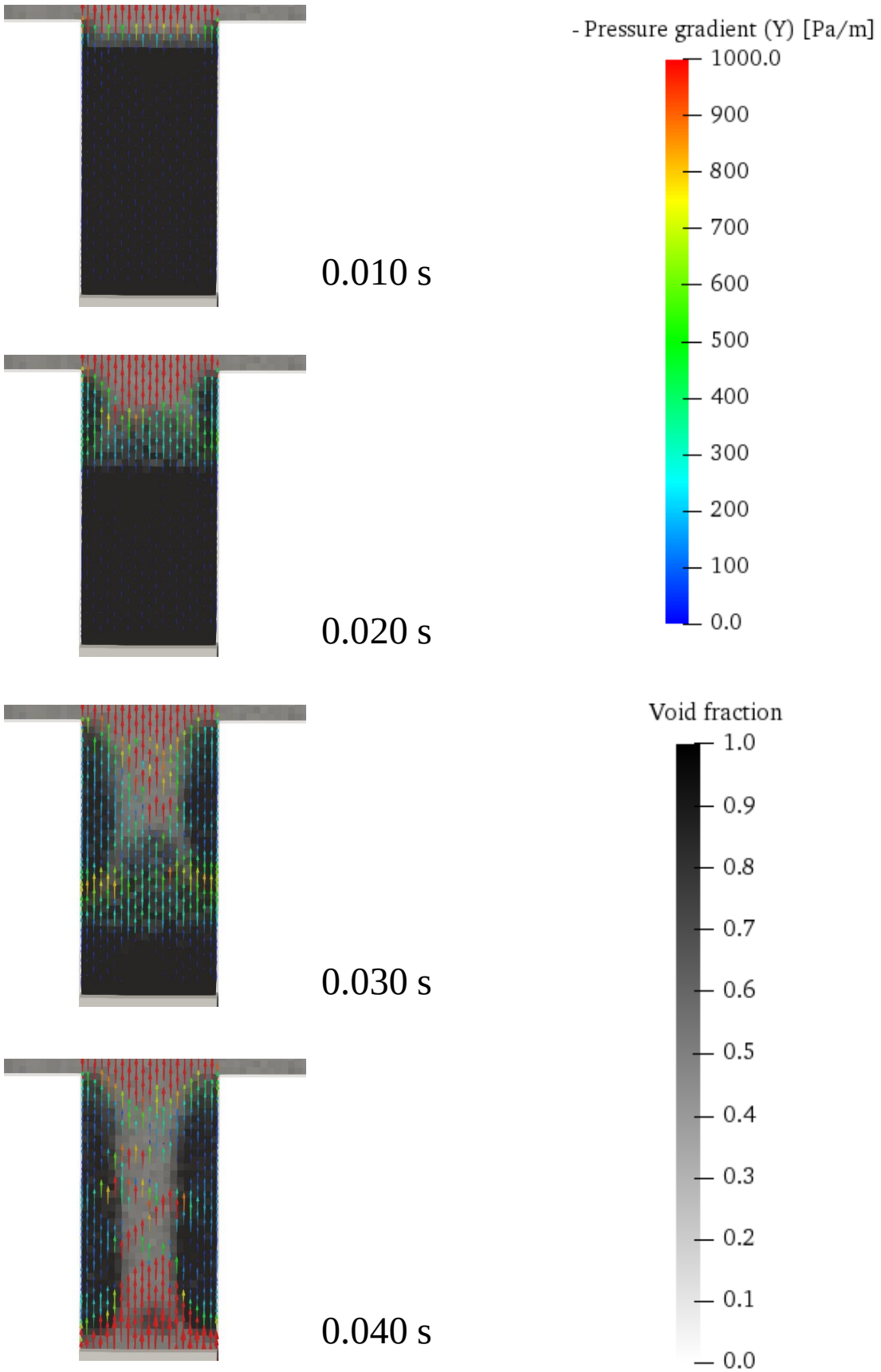


Figure 3. Pressure gradient

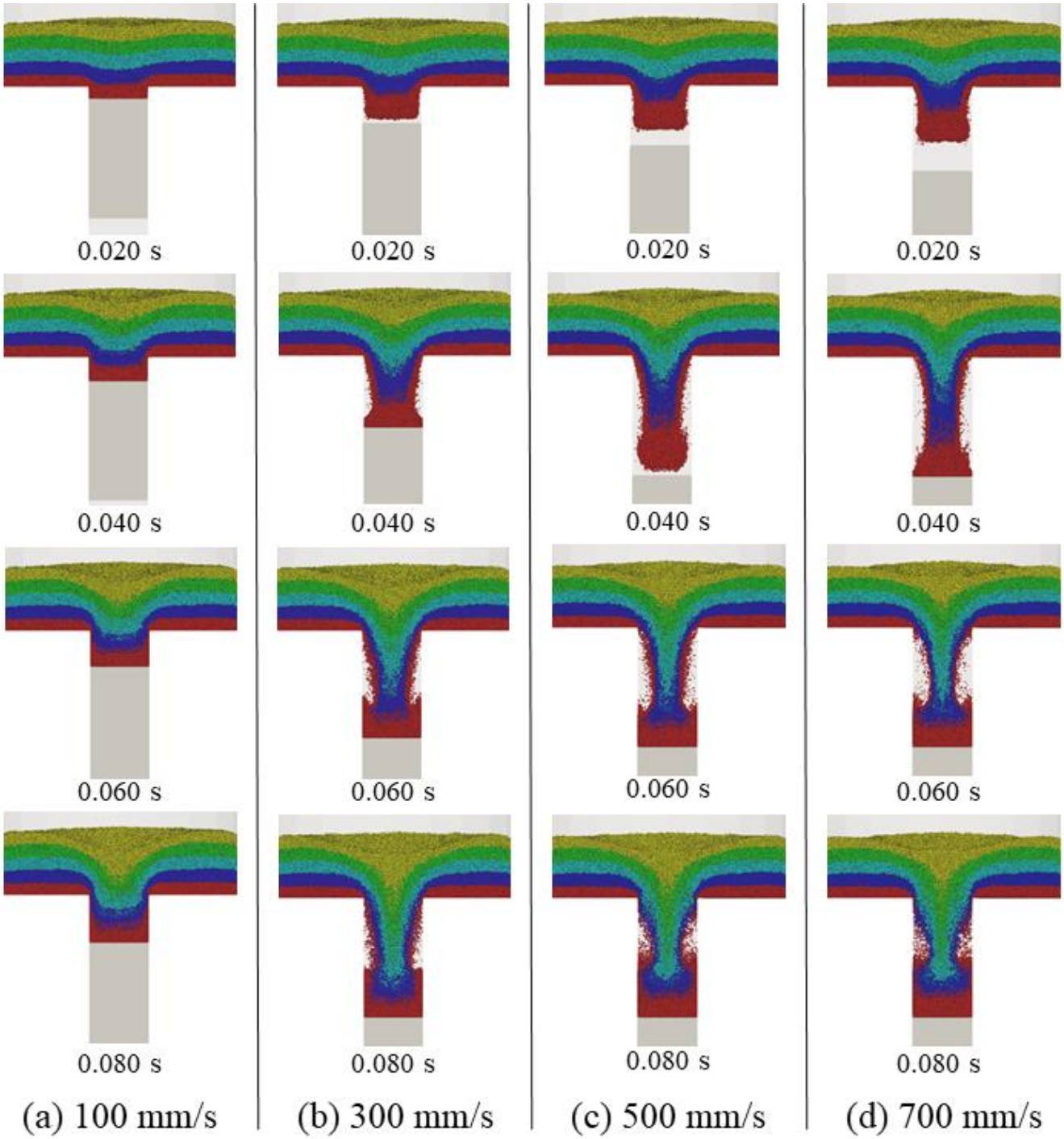


Figure 4. Particle distribution

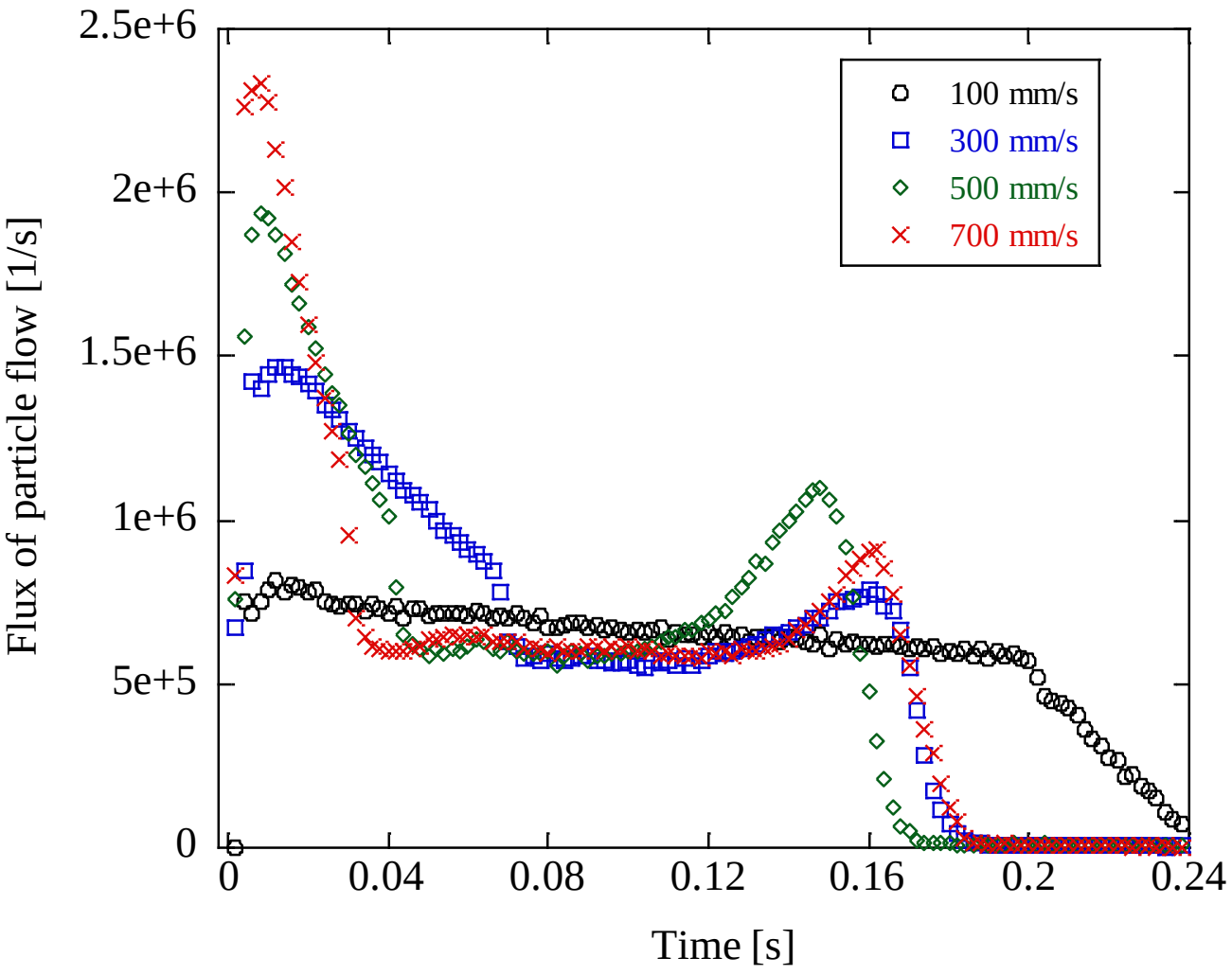


Figure 5. Flux of powder flow

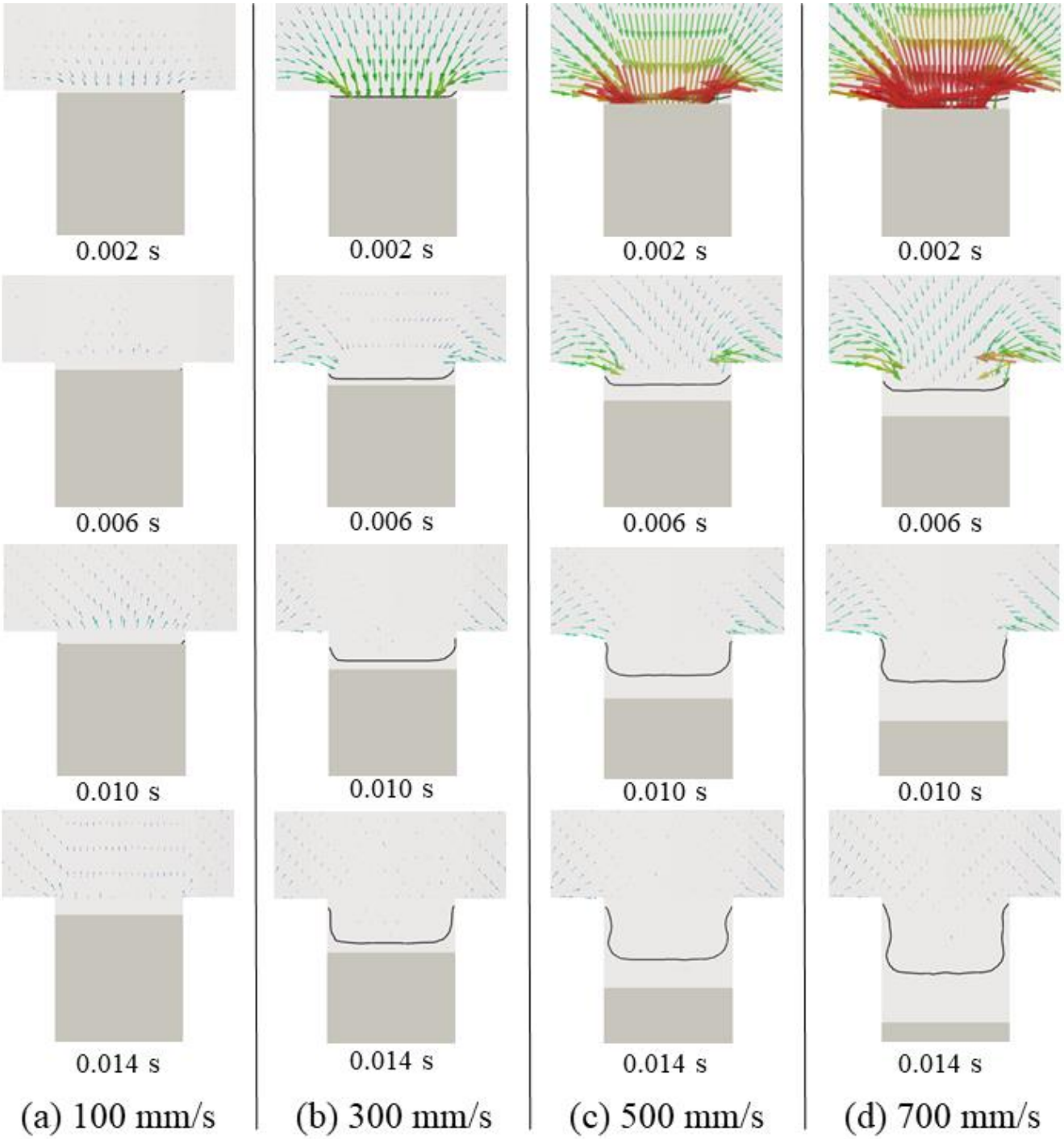


Figure 6. Pressure gradient

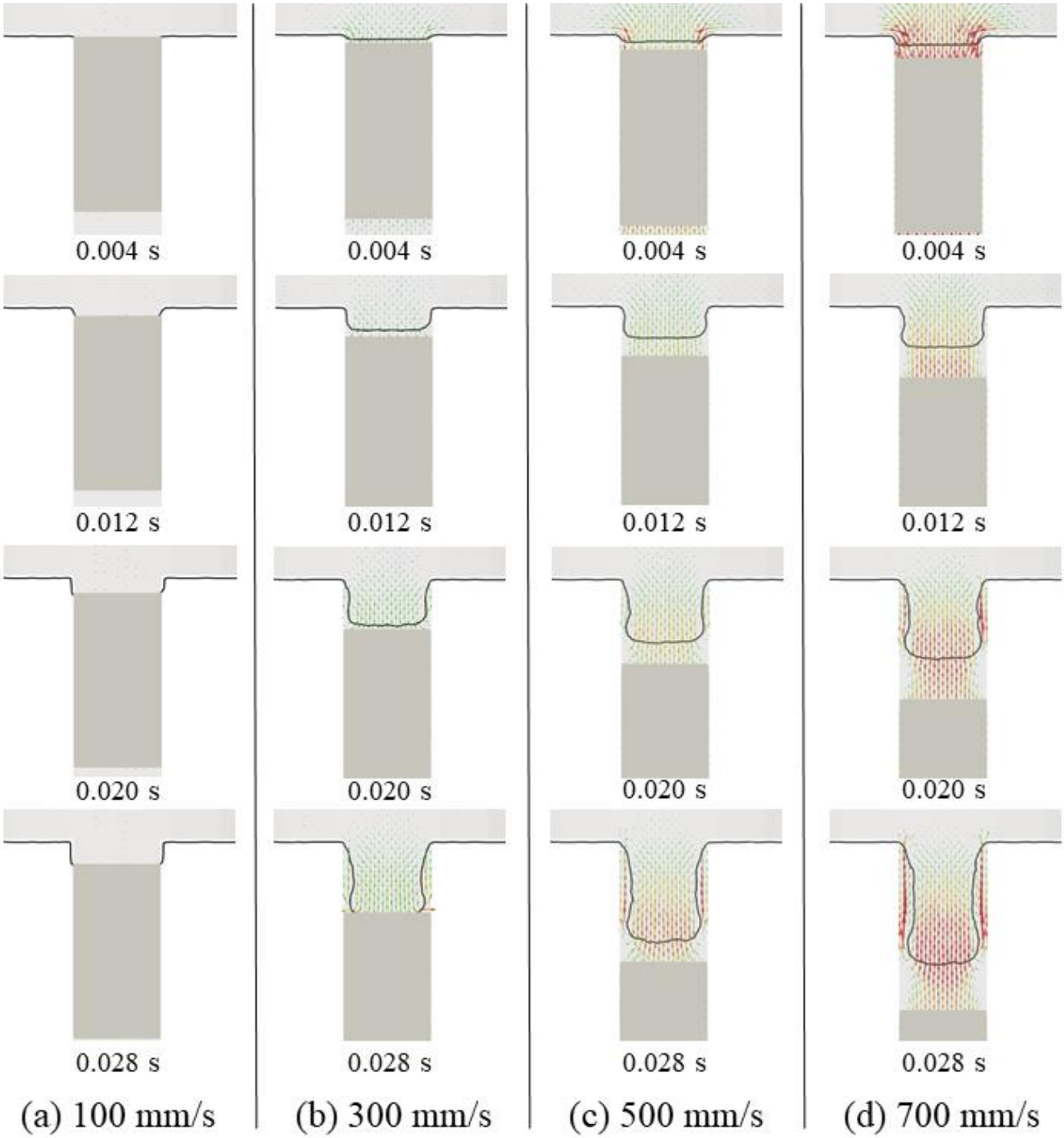


Figure 7. Air velocity

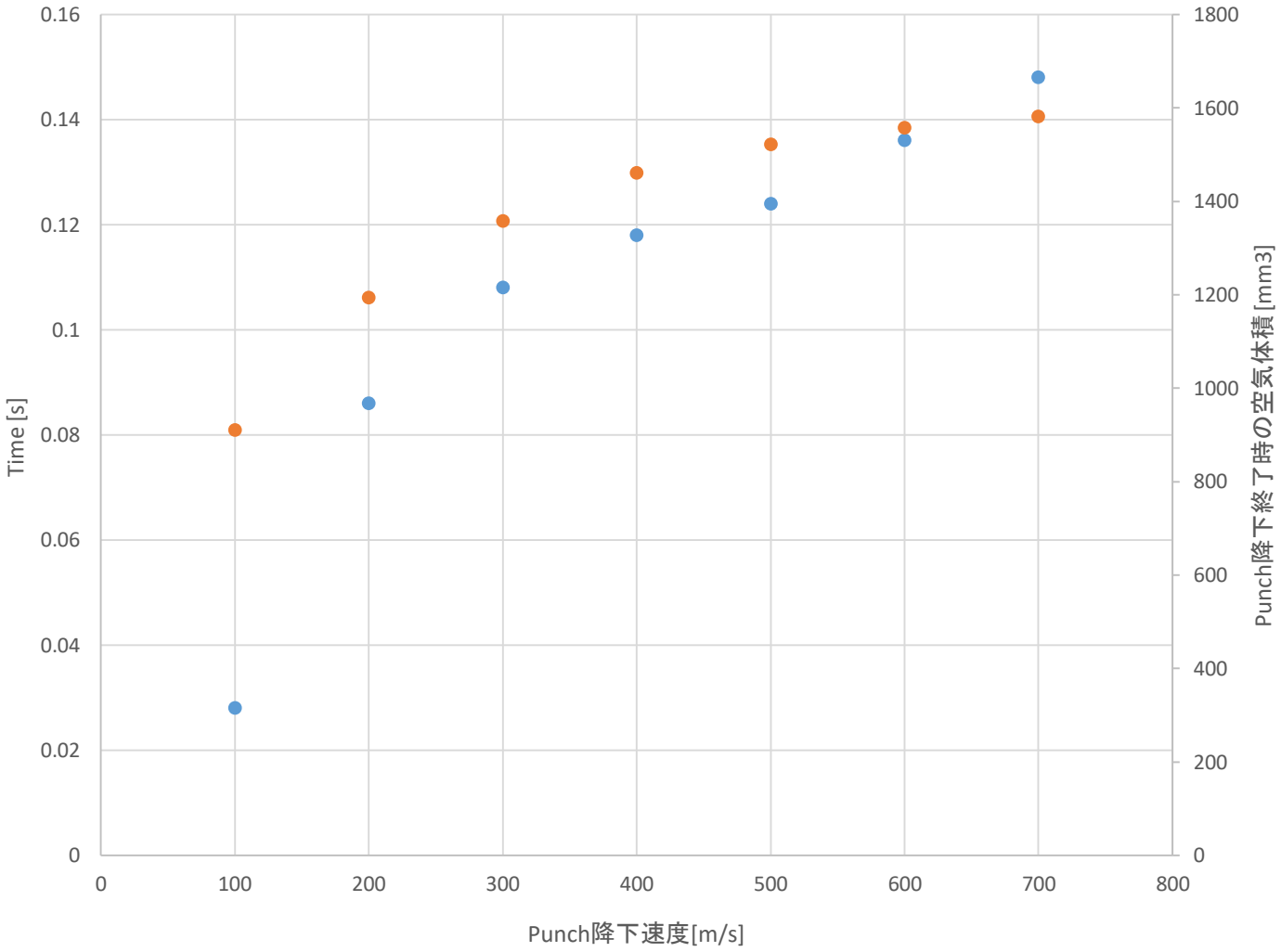
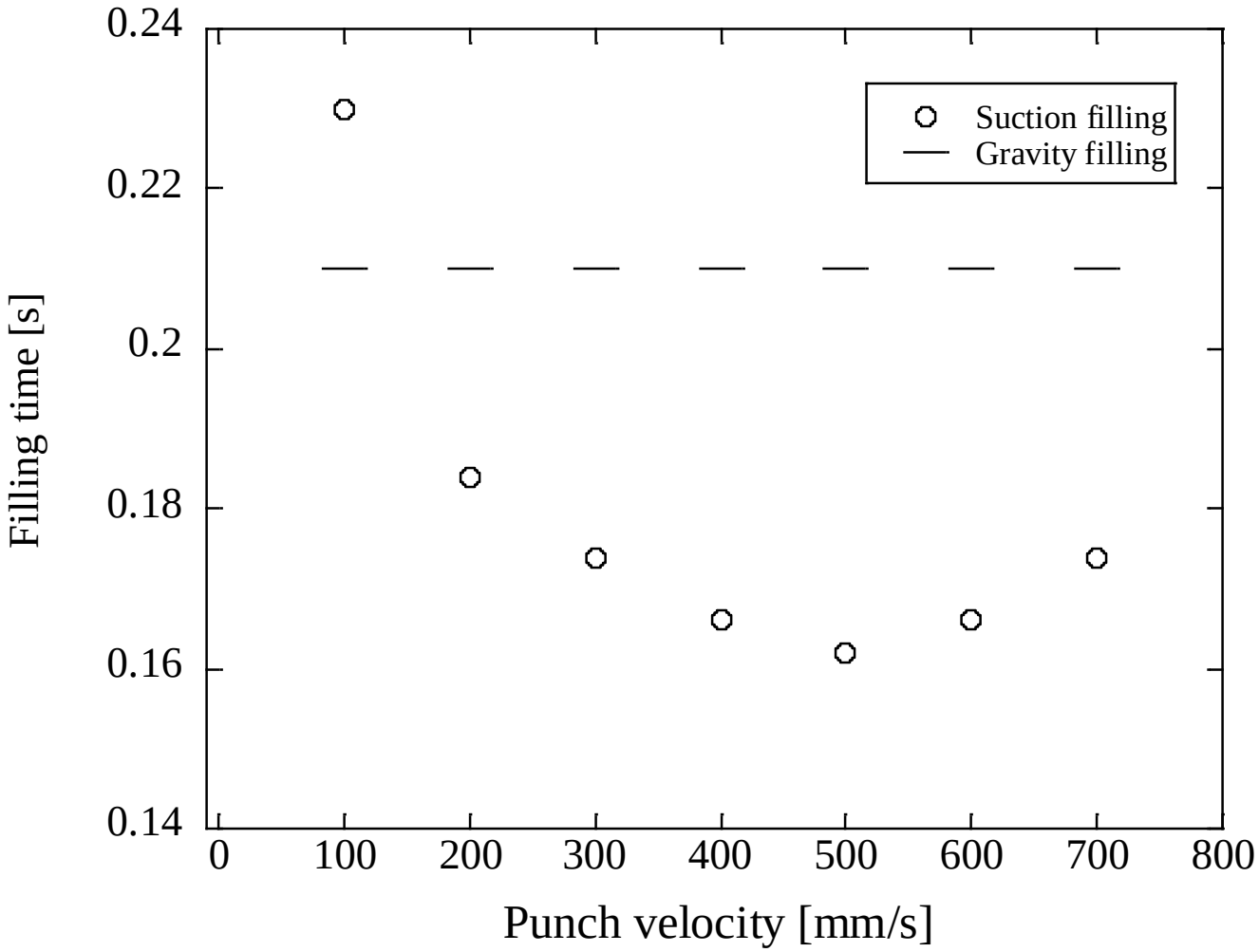


Figure 8. Bubble escape time and max volume


0.24
0.22
0.2
0.18
0.16
0.14
Filling time [s]
0
100
200
300
400
500
600
700
800
Punch velocity [mm/s]
Suction filling
Gravity filling