Electronic Supplementary Material (ESI) for Soft Matter.

Supplementary Figures: S1, S2, S3, S4.

Leidenfrost vapour layer moderation of drag crisis and trajectories of superhydrophobic and hydrophilic spheres falling in water.

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Figure S1. Photograph of the water vessel and heater device. The high speed camera used to monitor the sphere fall in the tank can be seen in the background.

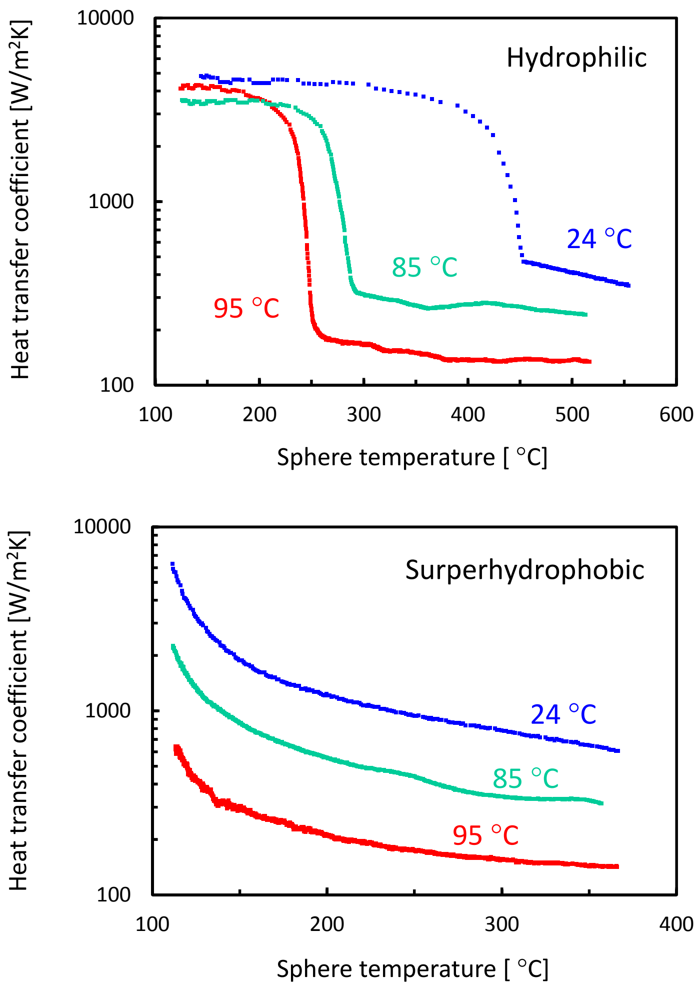


Figure S2. Average heat transfer coefficients, h for 20 mm steel sphere cooling in 24 °C water (blue line), 85 °C (green line) or 95 °C water (red line): (a) hydrophilic sphere, (b) superhydrophobic sphere, calculated using manuscript Fig. 2 data and the equation (see reference 31 in the manuscript):

$$h = \left(\frac{\rho_S c_p R}{3}\right)\frac{(dT/dt)}{(T_S - T_{sat})}$$

Where ρ_s = 7,700 kg m^{-3} is the sphere density, c_p = 466 J kg^{-1} K^{-1} is the sphere specific heat, (dT/dt) is the sphere cooling rate, T_S is the sphere temperature and T_{sat} = 100 °C is the saturation temperature.

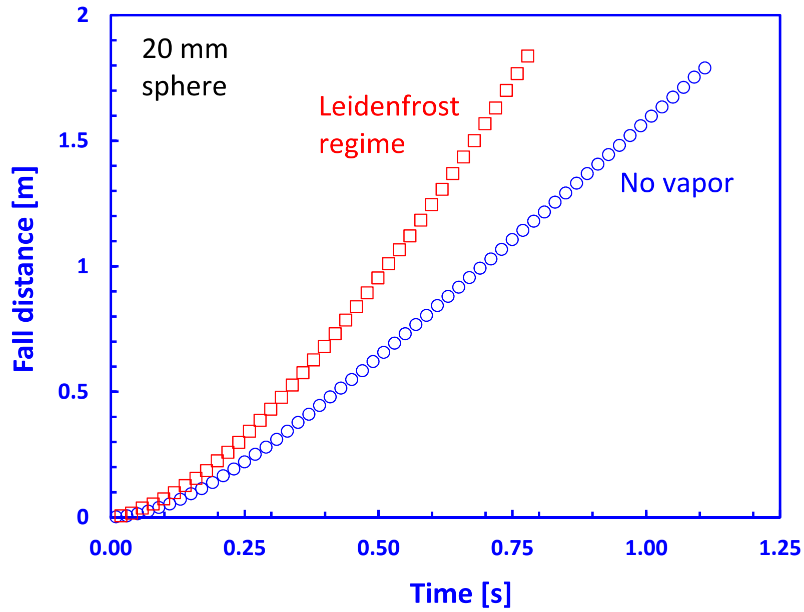
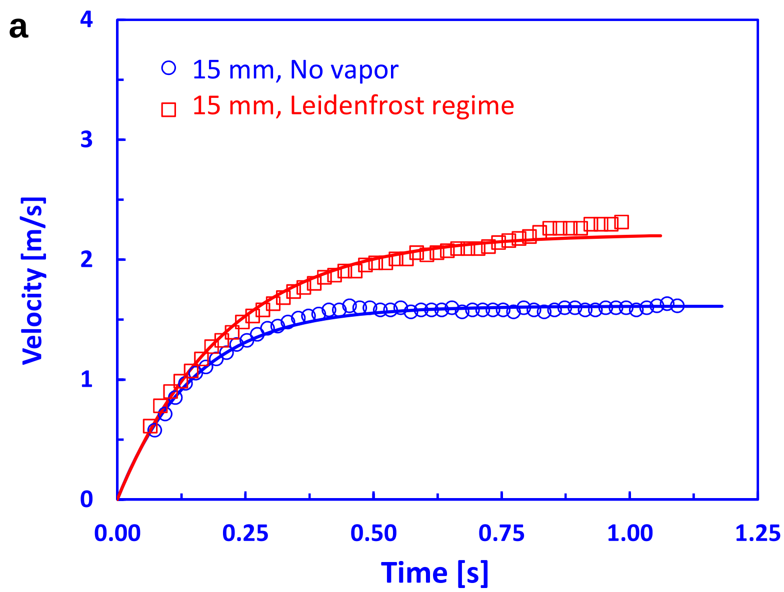


Figure S3. Examples for the fall distance *vs* time data obtained by image processing the video for 20 mm steel sphere falling through 95 °C water. Open circles (blue) are data for the for hydrophilic spheres at a sphere temperature of 95 °C, hence no vapour layer present, and open square (red) are for superhydrophobic spheres at a sphere temperature of 200 °C in the Leidenfrost regime case. The fall distance *vs* time data are used to obtain the velocity *vs* time data shown in Fig. S4.



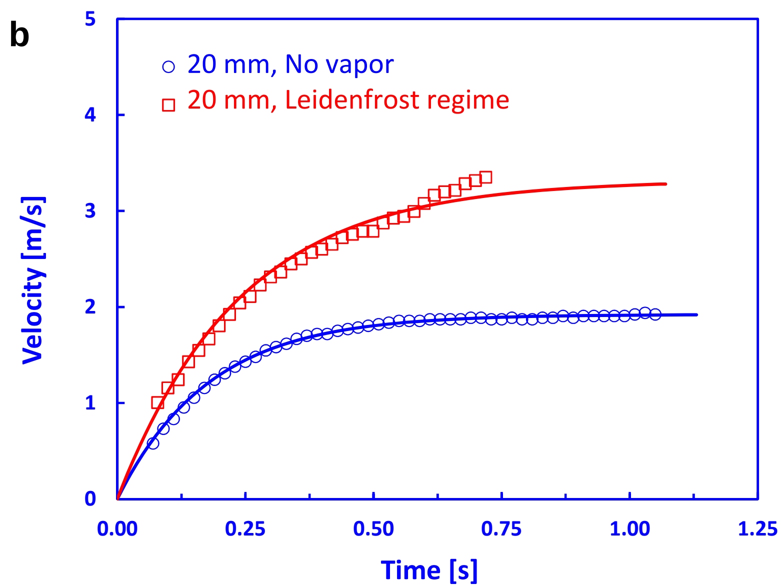
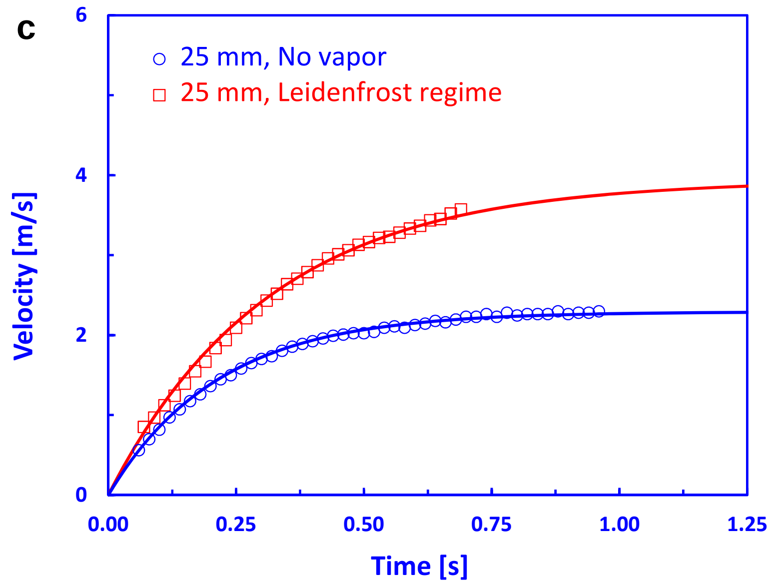


Figure S4a, S4b,



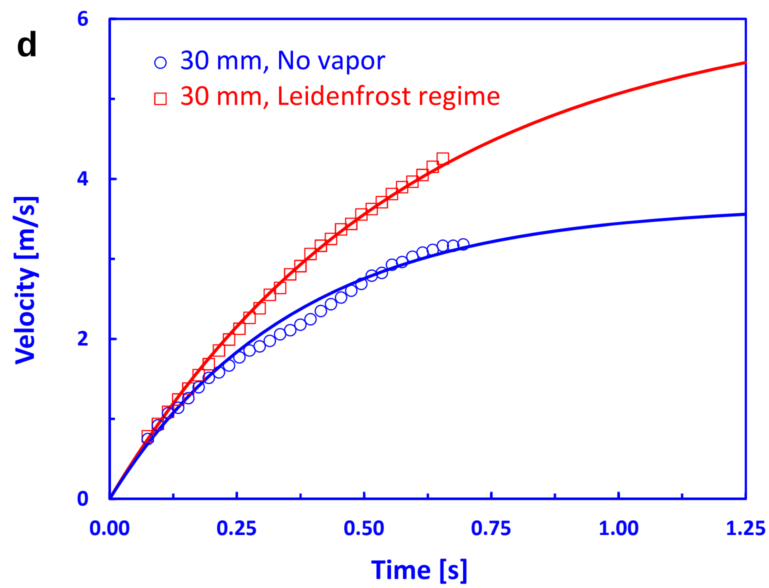
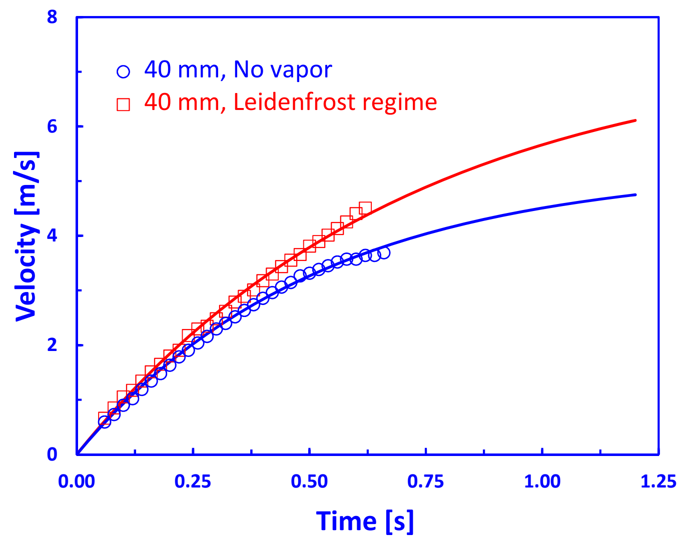


Figure S4c, S4d,

e



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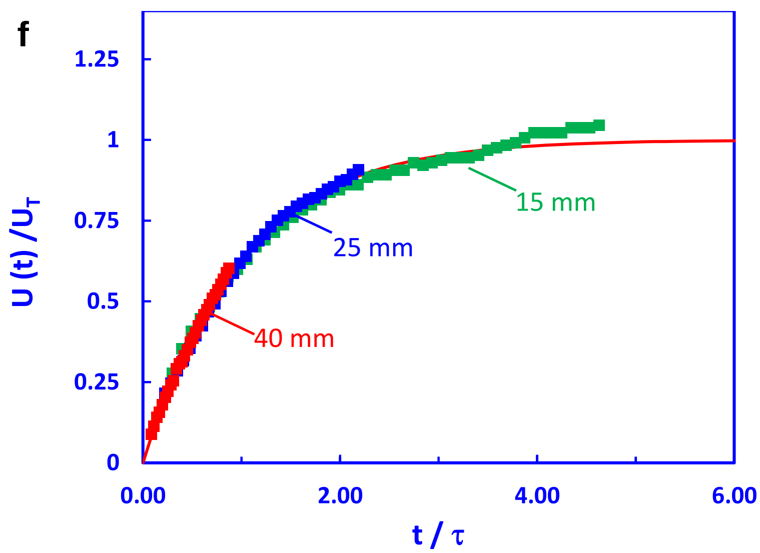

Figure S4. Collection of velocity *vs* time data obtained by processing the sphere falls in the 2 m tank videos. Each figure present data for a different sphere size: (a) 15 mm; (b) 20 mm; (c) 25 mm; (d) 30 mm; (e) 40 mm in the case of 95 °C hydrophilic sphere (no vapour layer, open blue circles) and 200 °C superhydrophobic sphere (Leidenfrost regime, open red squares) falling in 95 °C water. (f) Scaled data pertaining to superhydrophobic spheres in the Leidenfrost regime. The best fits with the exponential function: $U(t) = U_T [1 - \exp(-t/\tau)]$ are shown as solid lines.