Supplementary Information

Spatio-Temporal Maneuvering of Impacting Drops

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Methods

Fabrication of fin-structure with hydrophilic stripe by 3D printing. The fin structure is first fabricated by 3D printer (ZRapid iSLM280). Then, the silanized silica nanoparticles (Glaco Soft99) are sprayed to form nonwetting surface. After that, the hydrophilic stripe is generated by polishing the surface with a needle to remove the nano/micro-structure of the surface.

Observation of impact process. The impacting process is monitored with two high-speed cameras (Phantom M110 and *i*-SPEED 510) at a frame of 5000 fps. The releasing needle is mounted on the moving platform, and the Weber number is tuned by changing the releasing height of the drop.

Characterization. The nano/microscale structures are characterized using scanning electron microscopy (Hitachi S4800).

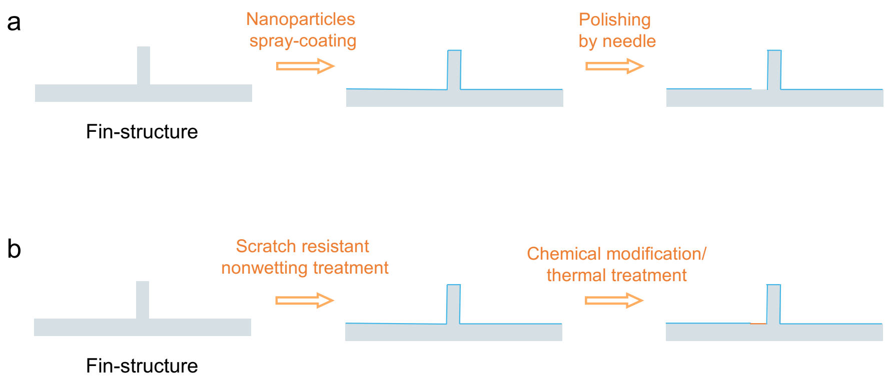

Fig. S1. The fabrication method for fin-stripe non-wetting surface. (a) The fin structure can be fabricated by 3D printing, numerical control processing technology or casting replication using metal, glass or polymer. Then, the nanoparticles are sprayed to form nonwetting surface, after which the wetting stripe is formed by polishing the surface. (b) For the scratch resistant nonwetting surface[1,2] with fin structure, the wetting stripe can be generated during the fabrication process of the nonwetting surface or by the available hydrophilization methods like chemical modification[3,4] or thermal treatment.[5]

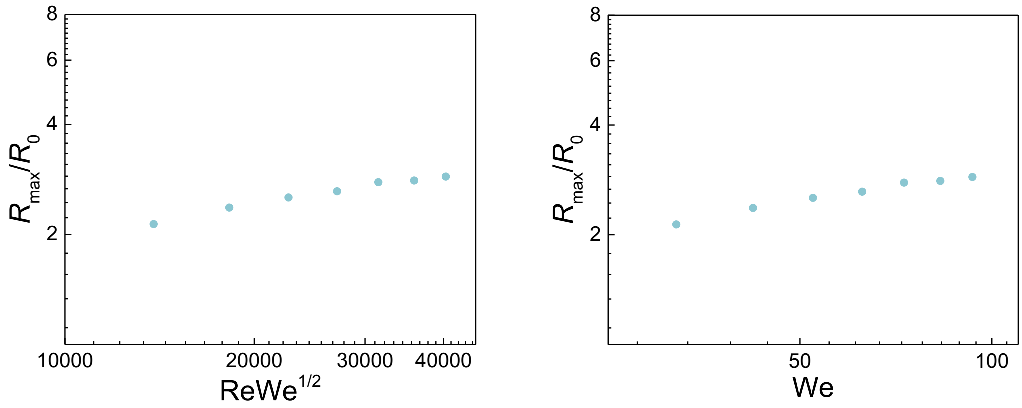

Fig. S2. The plot of normalized maximum radius $R_{\max}/R_0$ on flat nonwetting surface as functions of $\mathrm{ReWe}^{\frac{1}{2}}$ and We. The normalized maximum radius $R_{\max}/R_0 \sim (\mathrm{ReWe}^{\frac{1}{2}})^{\frac{1}{4}}$ or $R_{\max}/R_0 \sim \mathrm{We}^{\frac{1}{4}}$ based on the experimental values.

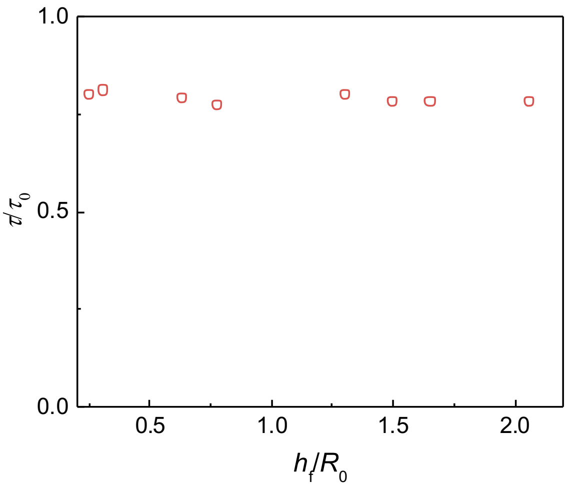

Fig. S3. The normalized contact time τ/τ_0 at different values of normalized fin height h_f/R_0 (from 0.25 to 2.05). Fin height shows negligible influence to the contact time. Weber number and offset distance are fixed at We = 22.9 and B = 1.4, respectively.

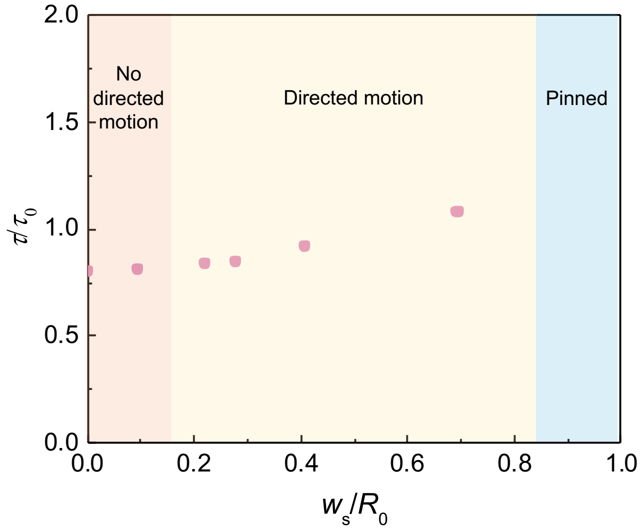

Fig. S4. The impact outcomes for different values of normalized fin height w_s/R_0. No directed motion, directed motion and pinned state appear as the w_s/R_0 increases. The tested width of wetting stripe w_s is from 0 to 1200 µm (w_s/R_0 is from 0 to 0.94). Weber number and offset distance are fixed at We = 47.1 and B = 1.4, respectively.

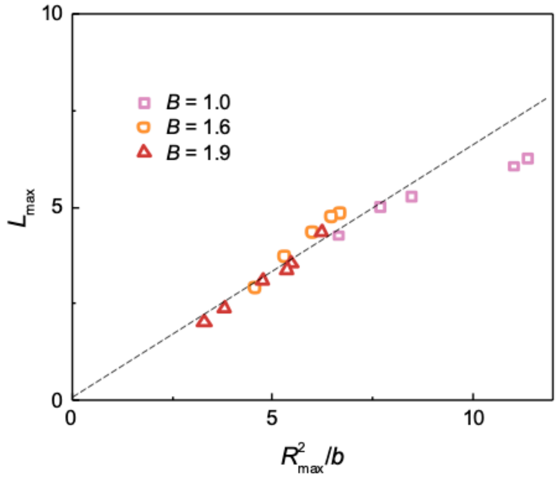

Fig. S5. The scaling of the maximum contact length L_{max} between the impacting drop and the nonwetting fin.

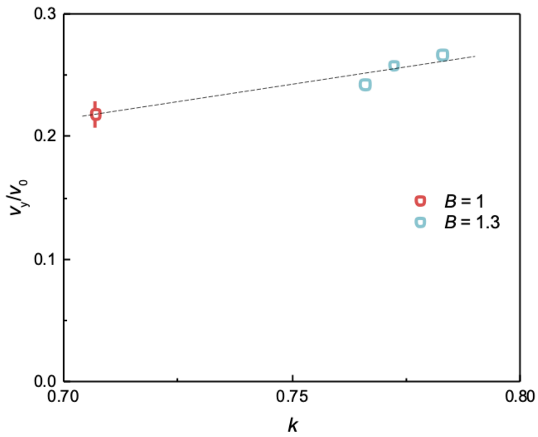

Fig. S6. The velocity ratio as a function of k, where $k = \tau/\tau_0 = \phi^{1/2}$.

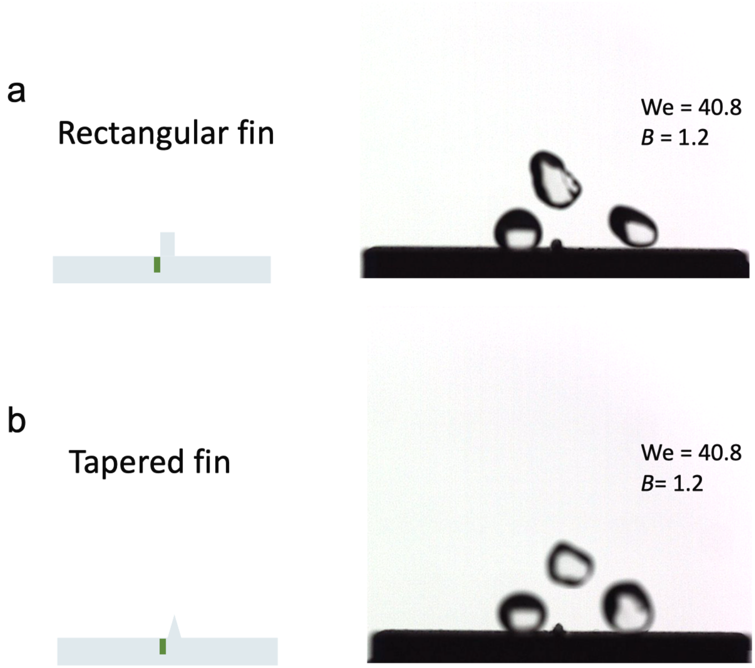

Fig. S7. The drop impact on fin-stripe nonwetting surfaces with (a) rectangular fin and (b) tapered fin, showing similar motions after the impact.

Fig. S8. The drop impact on curved fin-stripe non-wetting surface. The drop moves like the motion after the impact on flat fin-stripe non-wetting surface. The curvature of tested curved surface is 0.1 mm^{-1}, and Weber number of the impacting drop is 23.8.

Supplementary Movies:

Movie S1. The drop impact on sides of the fin with and without wetting stripe. Weber number is 21.8.

Movie S2. The drop impact on nonwetting fin. Weber number is 12.3.

Movie S3. The drop impact on nonwetting surface with wetting stripe. Weber number is 21.8.

References:

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