





Figure S2. Waterdrops rolled on $\text{Cu}^{2+}/\text{HNO}_3$ -etched zinc + fluoropolyurethane (rolling angle $8 \pm 1.6^\circ$).

Table S1. Uncertainty/error and parameters of non-standard design microchannel.

Parameters of Non-standard Design Microchannel	Set Value (SV)
Microchannel parameter and dimensions	100 mm \times 20 mm \times variable h; jet inlet/outlet: r = 5 mm, h = 10 mm
Volume flow rate	1×10^{-5} to 7×10^{-5} m ³ /s
Static pressure	0–2.5MPa
Fluids property	DI water: $\rho = 998.2$ kg/m ³ , viscosity 1.00 mPa·s;
Analogy method	Finite volume method
Solution method	Pressure-cased solver
Algorithm	PISO
Inlet condition	Velocity-inlet
Outlet condition	Free discharge
Test surface	(a) Unetched zinc substrate, (b) Unetched zinc + fluoropolyurethane, (c) $\text{Cu}^{2+}/\text{HNO}_3$ etched zinc, and (d) $\text{Cu}^{2+}/\text{HNO}_3$ etched zinc + fluoropolyurethane



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