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Effect of fluctuating pressure on plastron stability of superhydrophobic surfaces[1] LINFENG PIAO, HYUNGMIN PARK, Seoul National University — In the present study, we theoretically predict the collapse transition (depinning from the edge or sagging touchdown) and breakdown of a plastron on superhydrophobic surfaces made up of micro-scale grates, under fluctuating pressure. Assuming a sinusoidally oscillating pressure, we constitute an oscillator equation, considering a gaseous diffusion across the interface together. The modeled equation is solved for a wide range of parameters for surface geometry and fluctuating pressure. The results show that the plastron collapses even before reaching the critical pressure (i.e., water depth of application) determined under a static pressure. Depending on the behavior of interface, we also classify transient and long-term regimes where the roles of dynamic pressure and gaseous diffusion are dominant, respectively. The dependence of plastron longevity on the surface geometry is found that the plastron on low gas-fraction surface (which breaks in long-term regime) lasts days while the one with high gas-fraction ($\gtrsim 70 - 90\%$), more susceptible to pressure fluctuation, lasts a shorter duration. Finally, we suggest that property of sidewalls in surface morphology is critical in the plastron longevity.

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