Abstract Submitted
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Cavitation induced Particle Motion on Surfaces: A Model for Particulate Contamination removal[1] S. ROBERTO GONZALEZ-A, XIAOHU HUANG, PEDRO QUINTO-SU, TOM WU, CLAUS D. OHL, Nanyang Technological U — The motion of adherent polystyrene particles accelerated with a transient cavitation bubble is investigated experimentally. The bubble and particle dynamics is recorded with a high-speed camera. The particle trajectory is studied as a function of the initial separation and the particle diameter. For all particles investigated, i.e. 10, 4.5 and 2 μm in diameter, we find the same intriguing dynamics: a short initial separation (<0.7 Rmax) leads to a final displacement away from the bubble while particles at larger separations are effectively attracted towards the bubble. All particles follow the same master curve when the initial separation is nondimensionalized with the bubble diameter and the final displacement with the particle diameter. Our comparison of the trajectory to a force balance model indicates that unsteady boundary layers have to be taken into account. We studied the rolling dynamics induced by the strong shear flow and find angular speeds in excess of 400,000 rps for very brief times. We find that both torque and drag are important mechanisms for the removal of particulate contamination in cavitation based cleaning methods.

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