Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

The hydrodynamic interaction between a soft particle and a permeable surface GUY RAMON, Princeton University, HERBERT HUPPERT, University of Cambridge, HOWARD STONE, Princeton University — Practical experience has shown that permeable surfaces are more prone to deposition and, consequently, foul more than other non-permeable surfaces. This is due to the presence of an additional velocity component perpendicular to the surface. A particle will translate towards the surface at the same velocity as the background fluid; however, at close approach, particle interaction with the surface creates additional forces resulting from electrostatic, dispersion, polar and, the focus of this work, hydrodynamic interactions. A lubrication approximation is used to derive an equation for the pressure field; coupling with the elastic response of the particle allows evaluation of elastic interaction when the particle and/or surface are not completely rigid (e.g., soft polymer interfaces, bacteria cells, etc.). Useful asymptotic forms are derived, offering a clear and intuitive understanding of the force acting on a particle at close approach to a surface and its dependence on particle size, shape, the background flow and permeability of the surface.

Howard Stone
Princeton University

Date submitted: 02 Aug 2012 Electronic form version 1.4