<u>Module 9: Transport Characteristics</u>

- Plot net particle capture efficiency and inertial particle capture efficiency as a function of Stokes number for the two limiting cases of high-surface-energy and low-surface-energy substrates. Discuss the differences.
- Derive expressions for the terminal settling velocity of particles in the Re << 1 region, and in the Re > 1 regime. Comment on the particle-size dependencies observed. How would you incorporate the effect of a centrifugal field in these expressions?
- Write the expressions for deposition of particles by impaction and by Brownian diffusion on heat-exchanger tubes exposed to cross-flow of combustion products in a pulverized coal burning power plant. Identify strategies to minimize these deposition fluxes.
- Derive an expression for the net deposition velocity of a 0.5 μm sized particle on to a silicon wafer. Based on this, recommend strategies to minimize deposition. Indicate the particle size dependence of the following properties: (4 Marks)
    a. Brownian diffusivity
    b. Light scattering intensity in Rayleigh regime
    c. Drag force in creeping-flow regime (Re < < 1)
    d. Stokes' number

- Obtain an expression of particle settling velocity as a function of size in the case of Stokes' drag being opposed by gravitational pull.
- "In flow systems with steep temperature gradients, and broad range of particle sizes, actual surface deposition rates can exceed those predicted on the basis of heat-transfer analogy conditions by several orders of magnitude". Illustrate this with an example, and identify the augmentation mechanisms.
- State the three non-dimensional parameters used to represent particle deposition phenomena on surfaces. Of these, which may be corrected for "phoretic" contributions, and how?