

1. Determine the mean deposition velocities of 0.01, 0.1, 1 and 10 μm particles in a boundary layer flow of air over a flat plate at Reynolds number of $R_{eL} = 1000$ with $L=20$ cm.
2. Aerosol particles of 1 μm diameter are being passed through a filter of fibers which is 5 cm wide. The air stream velocity is 0.5 m/s and the fibers have a radius of $a=20$ μm with a concentration of 30% by volume. Find the ratio of outlet concentration to inlet (C_2 / C_1). For increasing the efficiency of the filter, should the diameter of the fiber be increased or decreased?
3. For 0.01, 0.1, 1 and 10 μm silicon particles in contact with a silicon substrate, evaluate the contact radius in the absence of external forces. Find the corresponding pull-off for each particle and compare with the weight of the particle. Also compute the maximum resistant moment for rolling detachment. (Hint: Use JKR model. Properties of silicon are given in the paper Soltani and Ahmadi, J. Adhesion Science and Technology, 1994.)