Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Image Treatment of Hybrid Drops in Low Reynolds Number Flow

D. PALANIAPPAN, Texas A&M University — Hybrid drops, also known as compound drops, consisting of two dissimilar configurations are encountered in processes such as melting of ice particles in the atmosphere, liquid membrane technology, evaporation of drops in a superheated liquid and in other various industrial operations. The flow fields around such hybrid drops form a basis for a better understanding of these industrial applications. Here we provide exact analytic solutions for a class of $3D/2D$ hybrid drops immersed in an infinite viscous domain in the limit of low Reynolds number. For mathematical convenience, the geometry of the multiphase droplet is composed of two overlapping spheres (infinitely long cylinders for $2D$ case) S_a and S_b of radii a and b, respectively, intersecting at a vertex angle $\frac{\pi}{2}$. The composite inclusion has the shape resembling a *figure-eight lens* type of object with a vapor S_a partly protruded into a fluid sphere S_b with a viscosity different from that of the host fluid. The mathematical problem with this twin-sphere assembly in the Stokes flow environment is formulated in terms of Stokes stream function with mixed boundary conditions and solved using the classical method of images. Singularity solutions are obtained for the hybrid droplet embedded in several unbounded flow fields and the force acting on the drop is computed in each case. Streamline topologies show interesting flow patterns and surprising, but interesting flow features are noticed in the case of two-dimensional flows.

D. Palaniappan
Texas A&M University

Date submitted: 03 Aug 2008 Electronic form version 1.4