
Abstract. Differential effective medium theory (D-EMT) has been used by a number of investigators to derive expressions for the shear viscosity of a colloidal suspension or an emulsion as a function of the volume fraction of the dispersed phase. Pal and Rhodes [R. Pal, E. Rhodes, J. Rheol. 33 (7) (1989) 1021–1045] used D-EMT to derive a viscosity–concentration expression for non-Newtonian emulsions, in which variations among different oil–water emulsions were accommodated by fitting the value of an empirical salvation factor by matching the volume fraction at which the ratio of each emulsion was experimentally observed to have a viscosity 100 times greater than that of the pure solvent. When the particles in suspension have occluded volume due to solvation or flocculation, we show that the application of D-EMT to the problem becomes more ambiguous than these investigators have indicated. In addition, the resulting equations either do not account for the limiting behavior near the critical concentration, that is, the concentration at which the viscosity diverges, or they incorporate this critical behavior in an ad hoc way. We suggest an alternative viscosity–concentration equation for emulsions, based on work by Bicerano and coworkers [J. Bicerano, J.F. Douglas, D.A. Brune, J. Macromol. Sci., Rev. Macromol. Chem. Phys. C 39 (4) (1999) 561–642]. This alternative equation has the advantages that (1) its parameters are more closely related to physical properties of the suspension and (2) it recovers the correct limiting behavior both in the dilute limit and near the critical concentration for rigid particles. In addition, the equation can account for the deformability of flexible particles in the semidilute regime. The proposed equation is compared to the equation proposed by Pal and Rhodes.