

266c Mixing and Flow of Partially Miscible Components in Submicron Channels - III

Ashish Nigam and E. Bruce Nauman

This is the third in a series of papers on unusual effects of mixing and chemical reaction in submicron reactors. The first paper addressed the classical case of completely miscible components. The second paper investigated the far downstream, striated flow of phase-separated, partially miscible components. The current paper treats the entrance length problem where the components are feed separately or are a non-equilibrium mixture that phase separates within the reactor. The solution technique, known as the continuous gradient method, combines a single time dependent version of the Navier Stokes equations with the modified Cahn-Hilliard equation for nonlinear diffusion. These two equations for flow and diffusion are linked by a body force term based on gradient energy. Results for concentration and velocity fields are calculated for both downstream regions and entrance region, for various cases including the case where viscosity is a function of concentration. The entrance length problem investigates the evolution of phase separation in a rectangular duct, both when two components are fed in the duct separately and the case where an initially homogeneous, single-phase mixture phase separates in the duct by spinodal decomposition. The method of false transients is used to find numerical solutions.