1110-65-34 **Thinh T Kieu*** (thinh.kieu@ung.edu), 3820 Mundy Mill Rd., Oakwood, GA 30503. *Expanded mixed finite element methods for the generalized Forchheimer flows of slightly compressible fluid in porous media.*

The nonlinear Forchheimer equations are used to describe the dynamics of fluid flows in porous media when Darcy's law is not applicable. In this article, we consider the generalized Forchheimer flows for slightly compressible fluids, and then study the expanded mixed finite element method applied to the initial boundary value problem for the resulting degenerate parabolic equation for pressure. The bounds for the solutions, time derivative and gradient of solutions are established. Utilizing the monotonicity properties of Forchheimer equation and boundedness of solutions, a priori error estimates for solution are obtained in L^2-norm, L^∞-norm as well as for its gradient in L^{2-a}-norm for all $a \in (0,1)$. Optimal L^2-error estimates are shown for solutions under some additional regularity assumptions. Numerical results using the lowest order Raviart-Thomas mixed element confirm the theoretical analysis regarding convergence rates. (Received January 19, 2015)