

Course CHEG 671 - Particle Transport

Credit Hours: 3

Instructors: Bell, Etchells, Simpson/Grenville, Tilton

Time: Mondays, 5 p.m. to 7:55 p.m.

This is a core course in the Masters of Engineering in Particle Technology (MEPT) program. It introduces students to the transport, flow and mixing of particles in liquid systems as well as systems where the fluid component is air or other gases. Additionally, the course includes material on the design of industrial-scale equipment and the selection of appropriate pumps, blowers, and agitators. Each of the instructors has at least 20 years of industrial experience.

The course discusses both the theory and practical application of particle transport. While there are fundamental equations involved, a substantial fraction of the practical application requires empirical correlations and laboratory measurements. Consequently, there is reliance on particle characterization as presented in CHEG 673 as well as handbook parameters and the industrial experience of the instructors.

Particle transportation (excluding mixing) is often not considered to be a unit operation of chemical processing. Transportation does not add value to a product, and it does not intentionally change the product. Consequently, the topic is often given scant attention in chemical engineering curricula. This neglect is especially prevalent with regards to dry solids, whose technology is rarely taught in U.S. universities. Failure to pay adequate attention to transportation can cause costly blockages, production rate restrictions and off-spec product.

Mixing in liquid systems is not a fully-mature technology as there are still problems to be solved. However, the state of the art is relatively advanced, and analogies to liquid/liquid and liquid/gas mixing are sometimes helpful. Dry solids mixing prediction (and evaluation) has not progressed as far.

Prerequisites: At a minimum, students should have completed an undergraduate course in fluid mechanics. A course in engineering mechanics or strength of materials is useful but not required. Most students will be seniors or first-year graduate students in chemical or mechanical engineering. Engineers from other disciplines and non-engineers must have the permission of the instructor to register.

Course Learning Goals:

- Understand the principles and design procedure for the transport of solid/liquid systems through pipes.
- Be able to calculate required operating conditions for solid/liquid mixing systems, and to define the requirements and scale-up techniques for solid/solid mixers.
- Understand the principles and design procedures for silo discharge by gravity, dilute phase pneumatic conveying, and transport with mechanical conveyors.