

SOLIDS PROCESSING

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1. INTRODUCTION

1.1 *Organization of the Course*

Chapters 1 and 2 of this course give an introduction to this course with an emphasis on industrial applications. Chapters 3 and 4 introduce you to fundamental properties of particles and particulate systems. The remaining chapters cover specific topics such as conveying, hopper design, and separations.

For undergraduates this is a design course, hence you are expected to apply design methodology. You will be assigned laboratory projects to work on in which you will apply engineering judgment with design skills to produce a final product. Graduate students are required to write a paper concerning a particular aspect of solids processing.

There are two labs in this course. The labs are well defined and structured. A few class periods are dedicated to the labs, though you will probably have to spend some time out of class to complete the labs.

Depending on schedules and availability, there may be a short field trip to tour a facility that handles bulk solids. Also, I may invite guest engineers to teach selected topics.

1.2 *Acknowledgement*

I acknowledge engineer Karl Jacob, at the Dow Chemical Company at Midland Michigan, for his enthusiastic support in helping me prepare and organize this course. Karl introduced me to many of the topics used in pneumatic conveying and hopper design and helped write many of the notes.

I acknowledge the National Science Foundation GOALI grant CTS 9613904 for its financial support that made it possible for Karl Jacob and I to collaborate in developing this course.

Finally, I acknowledge the American Filtration and Separations Society and its members' knowledge on a number of topics including particle size characterization, surface science and effects of surfactants, and various methods of fluid-particle separations. Many discussions with members of AFS over the past several years have helped me to refine my course notes and to focus on essential aspects of fluid/particle separations. The collective knowledge is vast and one course can only attempt to introduce students to selected topics.

1.3 Overview

Solids processing is a topic area that can cover a very wide range of processes. Processes could include:

particle sizing & shaping	crushing/grinding	catalytic reactors
flocculation	particle classification	settling
pastes	(separation by size)	agglomeration
packing & compaction	caking	drying
absorption/desorption	crystallization	digestion
mixing	separations	floatation
Brownian motion	fluidization	surface phenomena
leaching	filtration	ion exchange
rheological applications	slurry flow	packed beds

These topics and many more are covered in Perry's Handbook. Perry's Handbook has several chapters devoted specifically to topics in solids processing:

- Handling of Bulk Solids and Package of Solids
- Size Reduction and Size Enlargement
- Adsorption and Ion Exchange
- Gas-Solid Systems
- Solid-Solid Systems
- Solids Drying and Gas-Solid Systems

as well as many topics that are buried within other chapters.

Solids processing is an important part of industrial operations. In the chemical process industry roughly 60% of the products are particulate in form. When you add in products that at some intermediate step are in particulate form then 80 to 90% of all chemical processes used in industry require application of solids processing either directly or indirectly.

(These items are listed in **HANDOUT 1.1**).