Research Topic : **Real-Time Acoustic Monitoring of Drug Tablet Compaction**
Duration : **2006-Present**
Sponsor(s) : **Consortium for Adv. of Manufacturing in Pharmaceuticals**
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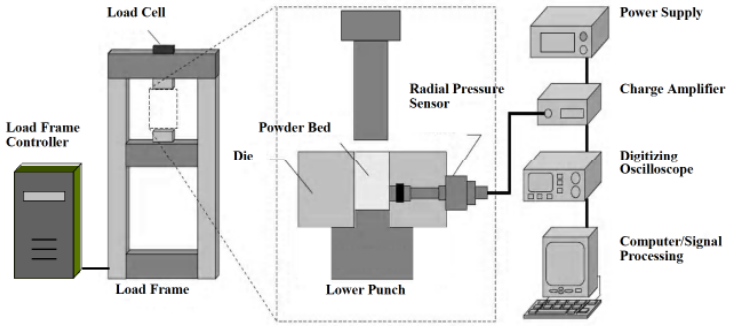
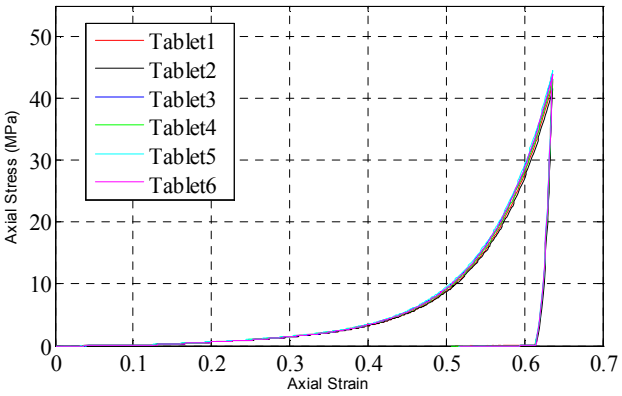
Synopsis of Research and Sponsored Projects

Compaction represents one of the most essential unit operations in the pharmaceutical manufacturing industry because physical and mechanical properties of the tablets, such as density and strength (hardness/friability) as well as the functional characteristics (e.g. dissolution rate) are determined during this process. The objective of this project is to develop real-time acoustic techniques for monitoring compaction in dies. In the Photo-Acoustics Research Laboratory, we utilize an instrumented die-punch setup and to simulate the compaction process, to extract elastic properties of drug tablet cores as well as to monitor the die-wall lubrication and die-fill height during pharmaceutical compaction process using acoustic methods.



Both analytical and experimental techniques are employed in our investigations for monitoring the pharmaceutical compaction process and determining the elastic properties of drug tablet cores. For a tablet core, which is made up of a series of compressed active ingredients and other excipients such as binders, and lubricants, the mechanical strength ("hardness") may be used to predict the structural integrity of a tablet and the ability to withstand subsequent handling and packaging. In addition, the increasing demands for better monitoring the processes are further recommended by Process Analytical Technology (PAT) which was launched by the U.S. Food and Drug Administration (FDA).

In this investigation, to measure the radial and axial stress components during compaction, a machined cylindrical die is used with flat-faced upper and lower punches for compaction experiments. A universal compression frame is employed for loading purposes and axial compaction force is acquired using a $10kN$ load cell. During the compaction process, a radial pressure sensor is utilized to obtain values of radial stress. Using the load frame, elastic properties are extracted from the measured axial and radial stress components during compaction.



In addition to air-coupled tests, contact acoustic measurements (in the ultrasonic spectrum) are conducted to demonstrate the potential and effectiveness of the presented acoustic monitoring platform by verifying values of elastic properties extracted using the compaction simulations. A good agreement is found between elastic properties extracted using both compaction simulations and contact measurements.

Recent Publications

1. C. Libordi, I. Akseli, Jingfei Liu, C. Cetinkaya, *Acoustic Real-Time Elastic Property Monitoring of Drug Tablet Cores during Compaction*, In preparation for publication in the Int. J. Pharm., 2007.

2. C. Libordi, I. Akseli, Jingfei Liu, C. *Cetinkaya, Non-Destructive Monitoring of Die-wall Lubrication and Die-fill Heights during the Pharmaceutical Compaction Process*, In the Preparation for publication in the J. Pharm. Sci., 2007.