DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering,

Master's Thesis Defense

Date/Time: Thursday 04JUN2015 from 10AM to 12PM
Location: Alumni Engineering Labs – Room AEL 275

Title: Evaluation and study on the adhesion of powder onto punch faces during tablet compaction

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Abstract

Sticking during tablet compaction is an issue that is commonly experienced during tablet manufacturing operations. The term 'Sticking' refers to a phenomenon that results in the adherence of materials onto the punch faces and die wall even after the tooling has left contact with the tablet. The occurrence of sticking during large scale tablet manufacture can produce defective tablets, halt manufacturing operations, and can be very costly. Currently, the mechanisms by which this phenomenon occurs is not clearly understood. However, numerous factors dealing with powder characteristics and instrumentation parameters are reported in literature to affect sticking. Therefore, sticking is a complex multifaceted phenomenon in which multiple factors can simultaneously contribute to the issue.

The aim of the work conducted in this thesis is to study the process of sticking. Ibuprofen was chosen as a model compound in this work as it is widely known to cause this issue. In addition,

evaluation of the sticking propensity of Acetylsalicylic Acid (ASA) and of a confidential compound is also presented. A customized punch with a removable punch tip was used to quantify the mass of adhered material on the punch tip during tablet compaction. The effect of particle size on sticking with ibuprofen was evaluated. Formulations containing 30% ibuprofen (AS-IS) and 30% micronized ibuprofen with 0.5% magnesium stearate and 69.5% microcrystalline cellulose were tested.

Results with micronized ibuprofen showed a marked increase in sticking compared to non-micronized ibuprofen. Significant triboelectric charging was observed with micronized ibuprofen. Analysis of the adhered material on the punch tip by SEM reveals the presence of both heavily deformed particles and minimally deformed fragments that are on the size order of well below 50µm. Triboelectric charging was also demonstrated to occur upon compaction with ASA. Results suggest that that particle size, static charging and fragmentation may play important roles in the mechanism of sticking in ibuprofen formulations. Furthermore, it is observed that sticking in ibuprofen can be influenced by cleaning of punch faces by solvents and by capping defects in tablets.