

**A review of rotating drum rheometer measurements used to characterize powders
for AM applications.**

Greg Martiska
Mercury Scientific Inc.
64 Barnabas Drive Unit 1, Newtown, CT 06470

Abstract

Rotating drum rheometers are widely used in the powder AM field to characterize powders. However, the measurements made by these devices are not well understood. This paper will review the various measurements made by rotating drum rheometers and how these measurements can be used to characterize powders for AM applications.

Introduction

Rotating drum rheometers have been widely used to study powders for AM applications for over 15 years [1-8] and powders in general for roughly 40 years. The concept of studying powder flow behavior in a rotating cylinder or “drum” was presented in Kaye et al [9,10] in 1995. Powder was placed in a clear cylinder with a light source in front of it. An array of photocells was placed behind the cylinder. The cylinder or drum was rotated, and the sample powder would prevent or allow light from light source to reach the photocells. In this way, the avalanching behavior of the powder could be studied. This concept was commercialized under the name Aero-Flow in 1996 by Amherst Process Instruments. As a result of this detection method, the Aero-Flow could only measure the time between avalanches.

The best detection method to study powder in a rotating drum is naturally a digital imaging device. However, in the 1990’s digital imaging devices and processing systems were expensive, and the time required to analyze a single image was roughly 20 to 30 seconds. This situation changed rapidly at the end of the 1990’s with increases in computer processing speed and development of inexpensive digital imaging devices. A commercial instrument using a digital camera to image the powder in the drum was