

Uniformity of Simultaneous Powder Deposition in Multiple Dies —Tester Design and Development, Measurement, and Modeling

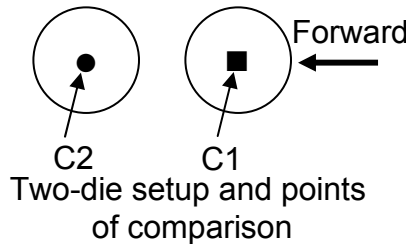
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INTRODUCTION

Non-uniform fill density within a die leads to several manufacturing problems, such as cracking, shrinkage, and lamination. To investigate the factors influencing the uniformity of powder deposition in a die or multiple dies, the second generation mass deposition tester (MDT-II), which is more flexible than the first generation MDT (MDT-I), has been designed, fabricated, and assembled. MDT-II incorporates a pressure sensor strip to measure mass increase profile at multiple locations simultaneously. A computer controlled linear actuator is installed to move and regulate the speed of the feed shoe accurately.



Photograph of assembled MDT-II



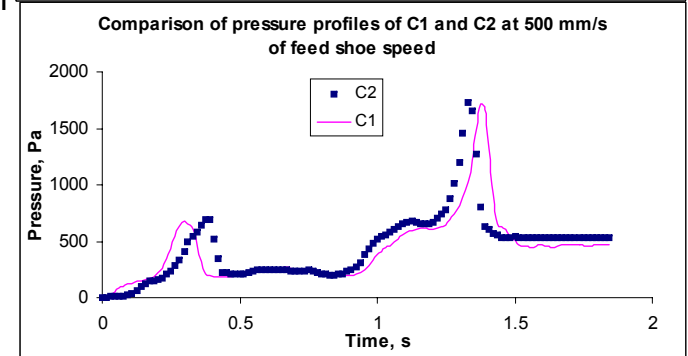
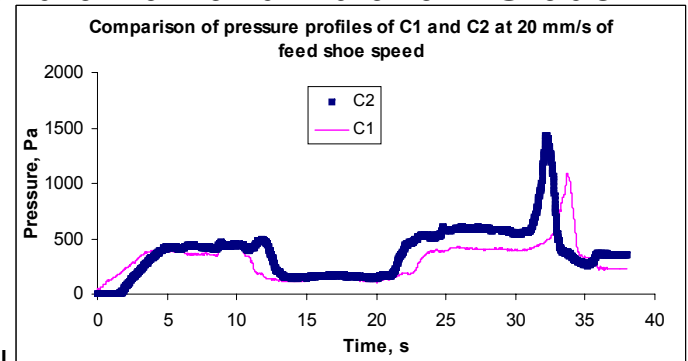
OBJECTIVES

Objective 1: To design and fabricate the second generation mass deposition tester (MDT-II) for evaluation of simultaneous powder deposition in multiple dies.

Objective 2: To employ MDT-II to collect data to test the effects of die configurations, feed shoe angles, fill directions, filling speeds, and powder characteristics, on uniformity of powder fill in multiple dies.

Objective 3: To obtain data using a computed tomography (CT) scanner for selected test cases used in Objective 2, and correlate these data with data obtained by MDT-II.

Objective 4: To develop and verify a phenomenological model to simulate the deposition process, and make recommendations for uniform filling.



SUMMARY AND ONGOING WORK

Objective 1: MDT-II has been designed, fabricated, and assembled.

Tests to date have proved that MDT-II is an effective and efficient device for real-time uniformity evaluation of simultaneous die fills.

Objective 2: Preliminary tests have been conducted as precursors to final and full series of tests on multiple die shapes, configurations and powder mixtures of interest to PM Center industry mentors.

Objective 3: Initial tests have been completed to evaluate the ability of the CT scanner to provide meaningful data for powder mixtures used in this study. Based on data analysis, the CT scanner results seem promising.

Objective 4: Preliminary physics-based model for die filling continues to be developed, which will be further modified, verified, and/or revised based on data from Objectives 2 and 3.