Durability Comparison

Wrought Steel Shot vs. Cast Steel Shot

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INTRODUCTION

This report is part of a study of steel shot peening media. The intent of the study is to determine the best media available for use in applications where high quality and high reliability shot peening is required.

The first phase of this study involves the comparison of the durability of cast steel shot versus wrought steel shot of the same hardness and general size.

Typically, cast materials are subject to normal casting defects such as hot tears, cold cracks, residual stresses, porosity, shrinkage and inclusions. Wrought materials, because they are hot and/or coldworked, have a more sound and homogeneous internal structure. One would, therefore, expect wrought shot peening media to last longer than cast media.

TEST METHOD

To evaluate the durability of different media, a relatively simple test was conducted under closely controlled conditions. The test equipment propels media against a hardened steel target at speed of approximately two hundred (200) feet per second. The media is then collected and recirculated back into the machine and propelled against the target again. Each pass through the machine is counted and reported as one cycle.

Each media to be tested was separated into its major size components. Cast steel shot size specifications normally contain at least two major size components (e. g., For MIL-S-13165 330 shot, a minimum 50% is between 16 mesh and 18 mesh and most of the balance is between 18 mesh and 20 mesh).

The size of wrought steel shot (Premier Carbon Wrought PWC) was more consistent. There is virtually only one size component (e. g., For PCW 32, all shot was between 18 mesh and 20 mesh) in this media.

A Premier Life Test was performed on all major size components of the media tested. The Premier Life Test consists of two curves. The first curve plots cumulative amount of media remaining on a specified test sieve against cumulative number of cycles in the test. The result of this test is the "Life" of the media (in number of cycles) at 100% breakdown. The second curve generated by the Premier Life Test is the "Breakdown Rate Curve" which is a plot of cumulative breakdown rate of the media against cumulated cycles. The Breakdown Rate Curve generally levels off to a constant rate near the point at which 100% breakdown occurs. A Premier Life Test for PCW 14H material is shown in Figure 1. The Life at 100% Breakdown is 3327 cycles and the Breakdown Rate at that number of cycles was 0.030 grams per cycle (100 grams divided by 3327 cycles).

For purposes of evaluating the durability of diffent media, the author selected the level Breakdown Rate at 100% Breakdown as the point of comparison.

RESULTS

Figure 2 is a summary of the comparison of three case steel sizes (CS 330H, CS 230H, and CS 11 OH) with three corresponding wrought sizes (PCW 32H, PCW 33H, and PCW 14H) all within the hardness range of HRC 55/56. This comparison shows some interesting results:

1. The Breakdown rate of wrought shot increased from 0.030 to 0.035 to 0.050 grams per cycle as the shot size increased. 2. The larger size component of the cast steel shot exhibited a much higher breakdown rate than the smaller size component.
3. In all cases, wrought media shoed a much lower Break down Rate than cast media.
4. The average Breakdown Rate of cast shot ranged from 4.4 times to 8.7 times that of similar size wrought shot.

CONCLUSION

Wrought media tested showed significantly higher durability than cast shot of similar size and hardness.