

# News Release

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## Image Analysis of Conditioned Cut Wire Pellets Gives Big Quality Gains for the Shot Peening Industry

By Mike Petrie, Taydor

The shot peening process relies for its efficiency on the maintenance of control of the medium in terms of particle size, hardness and density. Consistency is vital, not only in the original form, but also in the particles' resistance to rapid change in size and shape during the mediums' life cycle.

It is now generally accepted that the most critical characteristics of the medium for the end user are size, shape and hardness, as they alter in use, resulting in a distorted peening performance.

A leading media producer, namely Taydor, member of the Wheelabrator Alleward Enterprises group of companies, has introduced a new technique of Image Analysis by computer measuring both size and shape simultaneously.

It is believed that this is the world's first practical application of the technique by a media producer and after being in operation for around a year, it is already proving to offer a greater degree of accuracy and consistency in measurement and particle descriptive power, than the traditional methods of evaluation have previously achieved.



### TRADITIONAL SIZE AND SHAPE EVALUATION

The two methods widely in use are Sieve Analysis and high magnification Visual Inspection.

The new technique of Image Analysis as discussed by Bob Gillespie in a paper given to the 6th International Conference on Shot Peening, was considered to be potentially six times more precise than traditional methods of measurement.

In the traditional method of sieve analysis a sample of known weight is vibrated through a nest of up to six fine sieves, each with a graduated mesh size, decreasing from top to bottom. The sieves are agitated in a pre-determined manner for a fixed

time so that particles fall through progressively. The amount remaining in each sieve at the end of the process can be determined by weighing, and the residue remaining in each sieve is then expressed as a percentage of total sample weight.

Clearly those particles much smaller than the opening in each sieve will fall through quickest, and those that are almost the same size, as the mesh will take a longer time (if at all).

The amount of 'vibration' is of paramount importance for the procedure, and it is normal practice to determine 'Minimum Shake Time' by progressively increasing the period of agitation with the aim of determining the shortest period, following which there is not more than 0.5% of change in the residue found on all the sieves used.

Industrial standards and specifications following these procedures have been established over a number of years, and by careful control of time and the sieve material itself, variations in the results obtained by different companies have been controlled to a previously acceptable degree.

In the Visual Shape Inspection method, a single layer of sample is taken on a piece of clear tape, and examined, usually under a stereoscopic microscope, using up to 30+ magnification. An experienced operator is then required to make a judgement as to whether or not individual particles are acceptable, guided only by visual comparison of sketches contained in the pre-determined specification.

Modern standards of process control in the shot peening industry demand a high consistency of medium to a clearly quantified standard, and it is clear that both the methods currently in use are open to question in these terms, particularly when results from different production sources are being compared. It is in the light of these increasing customer demands for higher levels of confidence and repeatability, that Taydor has implemented a computerized system of Optical Analysis and linked it to their production and quality control systems in the production and processing of all three shapes of conditioning media.

### THE SYSTEM

The Taydor testing procedure utilizes a binocular microscope stepped through to a computerized image analysis system enabling both precise and repeatable measurements of the relevant characteristics.

Samples for evaluation are prepared by the use of a sub-sample obtained in the prescribed manner, poured into a 100 X 30mm mould, the bottom of which contains a piece of adhesive tape, enabling one layer of the abrasive particles to be retained for examination, this further being divided by means of an overlay, into four 25mm sections. Images of the four sections are then captured, computer analyzed and combined to give an

overall result, with range, average and standard deviation of the relevant measurements recorded.

The original reference points for the shape measurements were taken from VDFI 8001. Taydor has developed quantifiable measures for the G1, G2, and G3 shapes. Following the introduction of this new system, consistency and repeatability of roundness and size have surpassed all material produced under the traditional measurement control systems.

#### HIGHLY DESCRIPTIVE OUTPUT

The Taydor system is capable of measuring size (diameter) and shape (roundness) of as many individual shot particles as required, and then processing the results to demonstrate a wide variety of descriptive information.

At Taydor this information is used in two ways. Firstly, as a continuous check on the quality of factory output which has enabled efficiency gains in the conditioning process. Secondly, a Certificate of Analysis is available to the customer with each batch of product giving the precise level on conditioning (G1, G2 or G3) and expressing mathematically the exact definition of round.

This demonstrates with a better than ever level of confidence that the sample conforms within the band of tolerance defined for each level. On a practical level, it is clearly more relevant to know precisely the average size and variation in size of a medium, than to understand what percentage of a sample passed through a particular sized mesh.

#### IMPORTANT GAINS

Robotics and computer based control over shot peening equipment is now available to ensure precise application of the statistical process control parameters for ISO 9000 certification, for critical parts production. These systems accord with the move to tightened specifications applicable in quality control systems in universal use, particularly in the vehicle and aerospace industries. However the effectiveness of the systems is frustrated if the medium in use is itself of variable quality.

"Using the Image Analysis technique tied in with its accredited quality management systems, Taydor is able to assure customers that the level of conditioning supplied is precisely appropriate to the process for which it is required. Over conditioning, which creates higher costs and loss of product life and under conditioning, which can lead to a reduction in fatigue life of components, can now effectively be eliminated from shot peening. Through the use of image analysis techniques Taydor also believes that it will be possible to learn further about the effects of size and shape variations in the peening process, and predict the performance of both new and used media."

Taydor's conditioned Cut Wire Pellets are available and backed by the worldwide stockholding and servicing facilities of the Wheelabrator Allevar Enterprises group of companies, and specimen test results can be supplied on request from Taydor, Barracks Road, Sandy Lane Industrial Estate, Stourport on Severn, Worcestershire, England, DY13 9QF.

For further details please contact Mr. Joe Hill, Divisional Director, Tel: 44-1299-827212 and Fax: 44-1299-827056.

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