Volume 24, Issue 3 Summer 2010
ISSN 1069-2010

The Shot Peener

An OEM Makes a Bold Move


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Volume 24, Issue 3 **Summer 2010**

The Shot Peener

Dedicated to sharing information and expanding markets for shot peening and blast cleaning industries

The Shot Peener
23 years in publication
Over 6,000 readers
in 80 countries

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Articles

A Bold Move in Timid Times

> "We've always done things differently then our competitors, so we embarked on this journey to brand our unique approach. After months of internal review and a survey of our key customers, our process was solidified into the "Procise Process." We thought it was a great time to market this differentiation and update our name to better reflect our concentration on the surface treatment industry, despite the negative economic news. Our history is important and it defines us but we also must be current to remain competitive in the future."
>
> —Jim Whalen
> Vice President Sales and Marketing
> Progressive Surface (formerly Progressive Technologies)

"I'm not spending money on advertising and promotion right now. Let's conserve capital, let's wait to see how the factors that are out of our control affect business."

Have you heard similar comments or made them yourself? After all, it's wise to be conservative during a worldwide recession. Or is it? Could timidity cost your company an opportunity to grab market share from competitors?

A Strong Player Makes a Move

Progressive Technologies, supported by its 41 years in the surface treatment machinery industry, made the decision to capitalize on its strengths during a weak economy. The company recently announced its new name, Progressive Surface™, and solidified their successful business program into the Procise Process™.

The new name zeroes in on the company's core business. Progressive Surface manufactures, installs and supports shot peening, grit blasting, ultra-high pressure waterjet stripping and thermal spray coating machines. Progressive has installed more than 1,300 standard and custom systems in 33 countries for aerospace, medical, energy, and military applications. They succeed in a global marketplace where only a few manufacturers can meet—and anticipate—the needs of the most demanding industries in the world.

Marketing with Precision

Progressive Surface created a brand differentiation when it named its business strategy "Procise Process." A brand differentiation defines customer expectations and states how the company fulfills the expectations better than other brands (i.e., the competition). Progressive Surface delineates three elements of the Procise Process:

• Thorough Upfront Discovery
Our thorough upfront discovery determines your precise and unique requirements to ensure ultimate success.

• Process-Specific Design
Our expertise and experience in engineering, process, tooling, software, and automation are reflected in every detail of your equipment's process-specific design.

• Lifetime Support
Progressive customers are less likely to need after-sale service but if they do, they enjoy easy access and a lifetime of exceptional support.

Years of experience have proven that these three benefits are important to Progressive's customer base. Putting the three points in writing turns the Procise Process into a promise to fulfill expectations. Now prospects will question, "Can other companies match these commitments to me?"

Why Now?

Brand differentiation and the associated marketing is a financial commitment. A new web site, letterhead, advertising, and signage on trucks, buildings and equipment are a few of the expenses. And, as in Progressive Technologies case, it's wise to hire a marketing firm to develop and implement the name change and branding strategy.

So why invest in your image now?
1) Since most shot peening vendors supply more than one market, some of your market sectors are still expanding. Think energy and medical.

2) Your competition has probably slashed their advertising budget and are out of sight, out of mind.

3) And finally, it's a great time to promote elements of your brand that are crucial to customers that must justify every dime they spend. Surprisingly, price isn't always the deciding factor—peace of mind has tremendous value. Progressive Surface is offering a system that won't keep the buyer awake at night. **Thorough upfront discovery**: this machine will meet your needs now and in the future. **Process-specific design**: world-class talent in every step of the design and manufacturing process. **Lifetime support**: the ultimate security blanket in scary times.

Photographs: Progressive Surface's standard 5-axis robotic system Model RPB4848. Over 85 of these machines have been sold worldwide, mostly for aircraft engine component peening.

Procisely!

The **Procise** Process

Progressive™
SURFACE

How can I get a **surface treatment machine** that meets my expectations?

Procisely!™

Progressive Technologies has changed its name to Progressive Surface™, highlighting our core competencies in the design and manufacture of world-class surface treatment machinery. Our **Procise** Process™ is your guarantee of success.

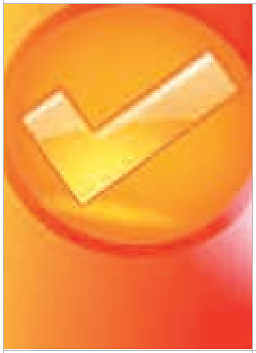
The **Progressive Procise** Process™ includes:

- ***thorough upfront discovery***
  Our discovery process *determines your precise and unique requirements, to ensure ultimate success.*
- ***process-specific design***
  Our expertise and experience in engineering, process, tooling, software, and automation are reflected in every detail of your equipment's ***process-specific design.***
- ***lifetime support***
  Progressive customers are less likely to need after-sale service but if they do, they enjoy easy access and a ***lifetime of exceptional support.***

The **Procise** Process™ guarantees that your **Progressive Surface** equipment will perform to your exact requirements—and beyond your expectations—for years to come. **Procisely!**™

Learn more about **Progressive Surface**, the **Procise** Process™, and our name change at:

progressivesurface.com



The Shot Peening Operator's Checklist

Part one of two-part series

In the current manufacturing world where quality *assurance* carries more value than quality *control*, it's important that you, the shot peening operator, apply this concept to your shot peening processes.

In this article, I'll review four key "quality assurance" equipment inspections that every shot (and glass bead) peening operator should conduct on a regular basis. The underlying assumption is that we are shot peening, not blast cleaning. To refresh, the purpose of cleaning is to remove contaminants like rust, scale, or sand from the surface of a metallic part, or to impart a profile (roughness) on the surface to facilitate better coating adhesion. Peening, on the other hand, induces compressive stress into the surface of the component. Induced compressive stresses counter the tensile or working stresses during the component's work life, neutralize the detrimental effect and prevent failure.

The degree of cleanliness is subjective. In comparison, peening results are objective and measurable. Peening performance is assessed by monitoring the intensity and coverage. Further, monitoring process variables, such as blast media size and shape, media velocity, media flow rate, etc., determine the repeatability and consistency of the peening operation.

Centrifugal wheel-style media propulsion systems and compressed air nozzles are typical shot peening machines. Our discussion will start with a very common exercise that should be routine for every operator. I'll then offer common inspection points for both types of shot peening machines.

#1 CONDUCT GENERAL MACHINE INSPECTIONS

As mundane and obvious as this sounds, general machine inspections will help you identify issues before they can negatively affect the peening process. This exercise won't take more than 10 to 15 minutes, and it should be carried out at the start of every shift. Listed below are some of the conditions that are identifiable during inspection, and their possible causes and effects.

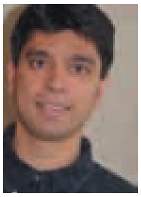
Oil leakage: Leakage of oil from a gearbox that's part of the media reclaim system could indicate future motor and gearbox failure, thereby disrupting machine operation. Needless to say, oil leakage is a safety hazard.

Media leakage: Assuming that the general housekeeping of your work area is acceptable, any media spillage that's above the routine must be investigated. In addition to being a slip hazard, a media leak indicates several things waiting to go wrong. Most of the time the location of the media leak will point you towards the source. However, sometimes the source of the leak isn't obvious, especially in a wheelblast machine with a leak on the ground below the storage hopper. In this case, the source of leak could be one of the flow control valves, a worn hose, or a leak from the blast cabinet being deflected by a machine component onto the floor below the hopper. The fix for each of these is based on the source.

> **PEENING TIP**
>
> **If the leakage isn't significant, it may not be visually noticeable. However, your intensity values and saturation curve will tell the true story. In an airblast machine, after the media flow is registered by your flow control valve to be 10 lbs/minute (for example), but not all of the media is propelled onto the part due to the leak, your results will start straying. Coverage will not be complete for the same cycle time as before.**

Damage to hoses in an airblast machine: Kinks in an airblast hose will lead to premature wear of the hose and potential leakage of shot. Premature wear not only happens on the outside of the blast cabinet, but could also take place inside the cabinet when the moving carriage rubs the hose against the cabinet wall.

Access panels: Open access panels, without safety interlocks, are safety hazards and invite



Kumar Balan is a Product Engineer with Wheelabrator Group and a presenter at the Electronics Inc. Education Division workshops.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0.1
0.15
0.2
0.25
Residual stress (MPa)
0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
Steel shot
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the entry of contaminants that could result in foreign object damage.

Limit switches: Loose limit switches could indicate the incorrect position of a nozzle carriage, risking damage to the workpiece.

Work handling equipment: If you have an inline machine with conveyor rollers, verify that the rollers are turning properly and in the right direction. Slippage in roller movement could leave a light part stranded inside the blast cabinet and damage it due to the continuous intense blast.

I suggest that you run a dry cycle (without blast media) for a few minutes after your inspection, before running your Almen test strips for the shift. Running a dry cycle will help you find problems before an expensive landing gear or engine component is loaded into the machine for processing.

PEENING TIP

Degree of wear on the blast hose is usually seen in the form of a 'soft spot' on the hose and, in some cases, the damage is clearly visible. A hose wearing on the inside may gradually disintegrate and small pieces of rubber contaminants plug the blast nozzle. The effect of a plugged nozzle on intensity and coverage needs no elaboration. Therefore, the first sign of such contaminants inside your hose should be an indicator to check the hose condition.

#2 WATCH FOR WEAR ON FIXTURES AND MOUNTING BLOCKS

Your peening test fixture is blasted more often than the actual part and subject to more wear than any other component of the machine. First and foremost, manufacture the fixture from wear-resistant material. The cost of faulty and incomplete peening results due to fixture wear can be very high.

The condition of Almen blocks, their position on the fixture and holding screws for the Almen strips should be regularly inspected.

PEENING TIP

If, at the beginning of your shift, you have an insufficiently covered strip, drastically different intensity values, or an absence of coverage, check the position and condition of the Almen blocks.

#3 RESPECT YOUR MEDIA CLASSIFICATION SYSTEM

The media classification unit in your peening machine is an important part of the process. Proper consideration should be given to the media type before selecting the classifier unit. For example, glass bead has a tendency to plug the holes due to their shape. In such cases, a ball tray or other self-cleaning mechanism should be installed with the classifier unit. Classifier units are built sturdy enough for peening applications.

Common issues with the classifier almost always involve the screen itself. Three such situations are:

1) Your peening machine is discharging a lot of good media into the trash container, robbing the system of useable media. This translates to frequent machine shutdowns due to lack of media. A possible cause is the top screen (in a two-deck classifier) is plugged (holes blinded), preventing media drainage and classification at the next level.

2) Your intensity values fluctuate drastically, prohibiting the plotting of a saturation curve. A possible cause is the blinding of the bottom screen preventing proper media classification. Right-sized media, along with fines, make their way to the blast tank, resulting in incorrect results.

3) The top screen develops a tear or a hole. Replace the screen before large contaminants reach your blast tank, plug the tank opening, or reach the blast nozzle. This situation could result in serious foreign object damage.

Respect your classifier and inspect it at least once a week if it's in a continuous production environment.

PEENING TIP

Use your ears. A good operator is conditioned to recognize unusual sounds. This could be the noise from a loose component in a blast wheel, a plugged nozzle, a rattling bucket in the bucket elevator, etc. These irregularities will have a detrimental effect on your peening results and lead to part damage.

#4 LOOK FOR CABINET WEAR

Though not a common occurrence in an airblast machine, wheelblast machines used for peening undergo gradual wear. Typically, these machine cabinets are fabricated from wear-resistant alloys such as manganese steel and lined with wear-resistant material. However, the travel path of blast media inside the cabinet is not predictable and a single piece of shot could find a gap through a worn liner and start eroding the cabinet wall, eventually leaking out of the machine. Cap nuts used to fasten liner plates on to the cabinet wall also wear and sometimes get dislodged. A loose cap nut, if not captured by one of the reclaim system components, could reach the blast wheel with disastrous results. Also, inspect the cabinet wear plates that are directly in line with the blast nozzles as these areas experience greater wear. Internal parts of the blast cabinet should be inspected on a regular basis, at least once a week.

Watch for more operator tips in the next issue of *The Shot Peener*. ●


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Peening Technologies: From Job Shop to OEM

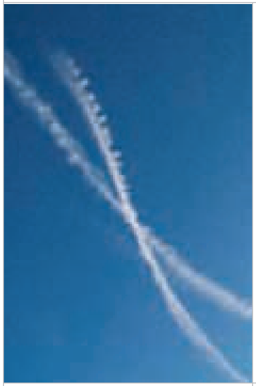
Peening Technologies of Connecticut has announced the formation of a new company called Peening Technologies Equipment, LLC (PTE). For over forty years, Peening Technologies of Connecticut (formerly Hydro-Honing Laboratories) has provided shot peening services to aerospace primes and specialty industries with unique quality requirements. "Our custom-built machines have been admired by customers, several of whom asked if we had ever consider selling them," said Walter A. Beach, Jr., Vice President. "At first we were reluctant to enter a crowded marketplace, but then we realized these companies were shot peening in-house or going to develop an in-house program whether we helped or not."

Since many of PTE's prospective customers are buying shot peening services from Peening Technologies of Connecticut, the new company's formation was a natural evolution. "We already know what the customer wants; there is little to no learning curve for us," said Beach. "An additional benefit is our capability to dual source parts. Our job shop facilities can provide extra capacity for PTE customers during their demanding cycles. We can also process parts should the customer suffer a natural disaster, labor issue, or other business interruption," he added.

PTE designs and builds CNC robotic peening machines. The machines are closed-loop controlled and exceed the requirements of AMS 2432 computer-monitored shot peening. PTE can support the customer with the equipment and documentation necessary to achieve Nadcap accreditation. (Peening Technologies of Connecticut holds the first Nadcap accreditation for shot peening and is an approved source for many aerospace primes.)

The family-owned and operated business has grown to meet the constantly changing needs of the aerospace industry. In 2003, they opened a satellite plant, Peening Technologies of Georgia, in Austell, Georgia. Together all three facilities provide a full range of shot peening services and equipment for a variety of industries including military, aerospace, power generation, and oil and natural gas businesses.

For more information, contact Tom Beach, President, or Walter A. Beach, Jr., Vice President, Peening Technologies of Connecticut, at (860)289-4328 or www.peentech.com.



Nex-Tech Processing

A Nadcap Success Story

For more than 30 years, Nex-Tech Processing, formerly Air Capitol Plating, has provided the aviation industry with metal processing, plating, painting and non-destructive inspection. Nex-Tech Processing, based in Wichita, Kansas, is a division of Nex-Tech Aerospace.

Dave Jones, Senior Quality Manager, explains his experiences with the Nadcap program.

The company has been involved with Nadcap since 2005 when we received a customer mandate to obtain Nadcap accreditation. In the five years since, we have not only satisfied that initial requirement but extended our accreditations to other special processes. We are currently Nadcap accredited for all three of our approvals: Chemical Processing, Non-Destructive Testing and Surface Enhancement (Shot Peening). In all three instances, we have satisfied the industry-determined criteria for superior audit performance and been awarded merit status. In real terms, as well as showing existing and potential customers that we know what we're doing, it means that we are visited less frequently by Nadcap auditors, resulting in resource savings.

Achieving Nadcap accreditation and merit status is not easy and in my experience, the biggest challenge relates to documentation. Most (if not all) processors work within the specifications set out by their customers. Despite this, providing objective evidence to support responses to the Nadcap audit checklist questions can sometimes prove difficult. For example, catch tests have always been performed but the instructions on how to perform them have always been provided verbally. The requirement for Nadcap, however, is a written procedure. How else can compliance be verified by a panel of industry experts?

There is light at the end of the tunnel— we have seen tangible benefits to being Nadcap accredited. For example, the company has experienced an increase in work from machine shops that are required to utilize Nadcap-accredited sources. We have also been able to make new contacts and obtain support from customers by attending the Nadcap meetings, which are a great source of information as well as an invaluable networking opportunity. Attending the Nadcap meetings allows us regular face-to-face time with the key decision-makers of aerospace prime contractors and helps us to build relationships with them that have proven to be very beneficial when questions arise in day-to-day business.

For companies interested in playing an active role in the Nadcap program, there are many ways you can get involved. Supplier input into the regular audit checklist revision discussions are welcomed, for example. I am now a Supplier Voting Member on both the Chemical Processing and the Surface Enhancement Task Groups. I got involved to better understand the checklists and also so that my company could have a voice in the changes that are flowed down from the Task Group. As I attended more meetings, I could really appreciate the achievements of the Task Groups and their willingness to listen to the supplier perspective. Over time, I was approached by the Supplier Support Committee Leadership Team to become a member representing the Americas. I accepted the role and embarked on the next step of my Nadcap journey.

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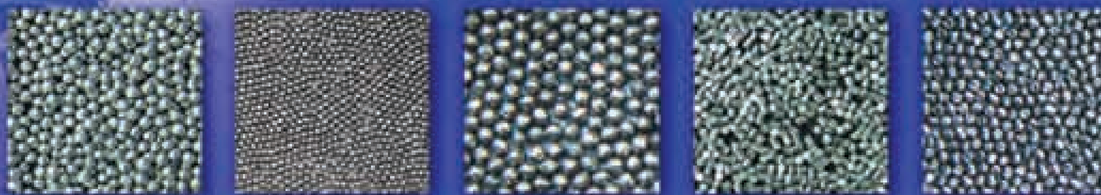
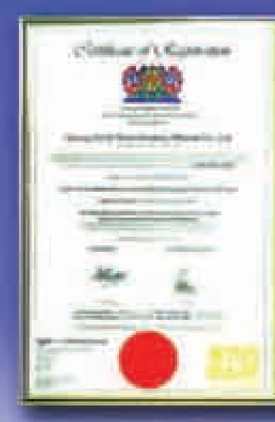


According to SAE J441 VDFI 8001 DIN8201 AMS 2431 MIL-S-13165C

Found in 1998 and now become the good manufacturer in the field of cut wire for shot peening and shot blasting:

Carbon steel cut wire shot HRC45-55/HRC55-60
Stainless steel cut wire shot SUS304/302/430
Zinc cut wire shot
Copper cut wire shot
Aluminum cut wire shot



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Do you have a question or problem related to shot peening? Online help is available in the Forum at www.shotpeener.com. The following are recent posts at the Forum—note that solutions came from the Forum Administrator, Jack Champaigne, and other forum members from around the world. The Shot Peening Forum is a tremendous resource and a good way to share your expertise with others.

Q&A

The Shot Peening Forum

Editor's Note: Posts have been edited for clarity

Surface Damage after Peening

Walter
East Hartford, Connecticut
Has anyone ever experienced this phenomenon? A part appears to be free of defects prior to peening, then after peening a scratch or nick becomes visible?

Socrates
There appears to be two alternatives as to scratch origin. Either the scratch was present before peening or it was imposed after peening. If it was present before peening then the scratch cannot be sharp and must have appear to have been "blurred" by the action of peening. If the scratch appears to be sharp, then it must have occurred after peening - as a result of part handling. A blurred scratch is rare but can be the result of a scratch having been smoothed over by a burnishing type of process applied prior to peening. During burnishing metal flows over the scratch hiding it from view. Subsequent peening then stretches the surface revealing a (blurred) scratch.

Gary J
Corpus Christi, Texas
Could it be that something has gotten into the working mix of shot that is being cycled through and shot at the part causing damage when it hits? Maybe bit of metal or something? This would be applicable on a system without classifier screens to take out stuff like that, of course.

Walter
East Hartford, Connecticut
The damage looks like a long scratch or groove that's been peened over. Problem is we are 100% sure it was not visible to the naked eye prior to peening. Socrates answer seems to have hit the nail on the head. Thanks for the info.

Conditioning New Cast Steel Shot

Gary J
Corpus Christi, Texas
I work for a U.S. Gov facility that is Nadcap certified, under AMS2430 (latest), and we use cast steel shot certified under AMS2431/1D. We also use "Frozen Processes" to maintain strict control of our process. We are not able to adjust any parameters that affect intensity without multiple levels of authorization. Our CNC machines are about 3 years old. We recently noticed intensity gradually climbing on some of our machines. We were out of our intensity limits in some cases. After looking at the obvious possibilities, we had no choice but to conclude that we had an issue with the shot. We discovered through in-shop testing that brand new shot had about .0015A less intensity than well-used shot. After shooting the new shot against a steel plate for about 2 hours, the intensity started climbing. I am unable to find any information on proper shot conditioning. Perhaps others in the industry simply adjust parameters when intensity climbs out of range, however we are bound by the frozen process controls. Also, the visual inspection in AMS-2430 condemns shot pieces that are considered "marginal" in AMS-2431/1. In other words, once I put brand new shot in my machine, what was acceptable is now unacceptable.
I need a way of getting this new shot to acceptable condition visually as well as pre-conditioning to avoid that climb in intensity that comes with normal use. Is there a proper method for conditioning cast steel shot before use in actual production? Is there an issue that needs to be addressed regarding AMS-2430 vs AMS-2431/1?

Lennart Almqvist
Sweden
We have stopped using cast steel shots since some years back. But looking back to the beginning of the late 80s, we realized that we had the variance you're referring to. We simply

added a requirement to our purchase specification as follows:

> All steel shot shall be subjected to 100 cycles of peening against a hardened steel surface. Shot velocity 60 ±5 meters/sec. Blast angle 90 ±5 degrees. After cycling the shot shall be size graded, to fulfill sieve analysis requirements of AMS2431/1.

After incorporating conditioning of shots at the shot supplier, we got away from that problem.

Walter
East Hartford, Connecticut
I agree with Lennart with regard to the pre-conditioning of new shot prior to use as a best practice. Also, I would suggest that when adding shot to your machine you never add more than 30% of the total hopper capacity. Be sure to add it slowly, mixing it in with the shot already in the machine. You state that you cannot adjust any of the parameters that affect intensity. Don't you have a tolerance range for your air pressure and shot flow? You are permitted to adjust your target point in a frozen process as long as you don't violate the limits. You should be able to adjust within your tolerance band to mitigate a slight rise of .0015". A combination of less air pressure and an increase in shot flow should do the trick. Of course you must run a new 4 point saturation curve to verify you are incompliance.

Gary J
Corpus Christi, Texas
Walter, I am afraid that "frozen" means just that. A change in air pressure and/or media flow can be done but not without going through the channels to change the frozen process plan. Perhaps this issue has not been addressed because most of the industry simply adjusts as necessary to stay on target. The parts we programmed and "froze" back when the CNC machines were new were done with new shot. This means that our T1 was perfect then but is high now that the shot has been conditioned through use. I am wondering if this is an issue that needs to be addressed industry-wide or in the AMS standard. The gentleman from Sweden got away from cast-steel shot completely because of this so it would seem we are not alone. I would like as much input on this as I can get.

Pete Bailey
Hamilton, Ohio
You probably realize that the AMS2431/1 shot is hardening as you use it—that is why intensity is increasing. The two suggestions are correct(1) condition the shot before using it on parts and (2) establish an allowable pressure (and shot flow)range as part of your fixed process.

Walter
East Hartford, Connecticut
I'm not asking you to change your process only adjust it within the Frozen limits. Typically PSI has a ±5 PSI, a similar tolerance would apply to shot flow in pounds per minute. You machines should have an interface that allows the operator to make these subtle changes. Just to be clear, what I'm saying is of your frozen process calls for 50 PSI ± 5 you can set your machine to run at 50,51,52..... as long as during the process is never drops below 45 or goes over 55. You have to have this flexibility, your machine is physically changing all the time as all peening machines do. Example your blast hose and nozzles get larger with use. Obviously at some they would need to be replaced as part of your preventive maintenance plan. Also, temperature and barometric pressure can cause variation.

As for the AMS 2431/1 shot in your machine. You're right, it does work harden with use that's why we don't use very much of it at all. Your used shot could possibly now be AMS 2431/ 2 shot. Have you had the suspected shot in the machine hardness tested?

Why did you choose AMS 2431/1 shot? I'm guessing cost, as very few OEM's required regular hardness shot. If at all possible I would switch to AMS 2431/8 Conditioned Cut wire shot. Although it is more costly up front it lasts many times longer. Also, CCW never fractures, it just gets smaller with use. It's hardness range by specification is 55-65 just like AMS 2431/2 however I have never seen it vary by more than 3 points. Meaning it's much easier to add to your machine since it hardness variation is considerably tighter than cast steel shot thereby making saturation curves easier to reproduce.

AMS 2430 is currently being revised. The intent is to change figure 1 and 2 to show only acceptable shapes anything else would be bad.

What type of shot classification system does your machine have? If you have just a size classifier your may have problems removing some non-round particles. You need to run the shot through a spiral device to remove these.

Feel free to call me to discuss if you need to. I sent a reply to you via this website with my contact info.

Socrates
Several issues can be identified:

1 A "frozen process" is only effective if all of the parameters remain virtually constant. The "frozen process" parameters should not have been established using new shot. Shot properties change with use. These include a reduction in average shot diameter and 'conditioning' of the particles. The process parameters should be re-established using a shot load that is "stable." A stable shot load is one that is screened regularly and has regular, small, additions of new shot trickled in to replenish shot losses. The new shot additions may, or may not, require to be pre-conditioned.

2 There is a lack of information presented about how the 'intensity' changes are being measured. Are the stated changes for complete saturation curves or are they simply changes in the arc height for a fixed peening time? If the changes are detected using complete saturation curves then which method is employed to determine the 'peening intensity' point from the set of data?

Joe McGreal
Monticello, Iowa
After reading your post, it sounds like a problem related to the size control of your shot. I don't think it's a "cast shot" problem. Most intensity problems can be traced back to shot size control. You stated, after two hours the intensity increases in some of the machines? The physics of impacting shot particles is a continuous reduction of size and

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Innovative Peening Systems is a manufacturer of high quality automated shot peening and abrasive blasting machinery. Our CNC robotic computer controlled shot peening and abrasive blasting machines offer cutting edge motion control and shot delivery technologies. Machinery meets or exceeds AMS-2432 and AMS-13165 specifications.

Our CIMCAP (controlled intelligent motion computer alarmed parameters) software is a PC based operator interface for process reporting. This closed loop system allows for detailed process monitoring.

Other machinery types include blast rooms, centrifugal wheel (roto) blasting machines. IPS also offers a detailed job shop for shot peening, plastic media blasting and machine repair and modifications. Our airfoil coatings job shop provides sacrificial protection reducing corroding and eroding while leaving substrate metal intact.

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mass (intensity). The increase you describe is counter to the known endurance of the shot particle's size.

Preconditioning of shot is a best practice for removing oxide and fugitive particles, however I don't think it will assist in solving your problem. You mentioned shooting shot against a hard steel surface for two hours and noticed the intensity increasing. How many passes is two hours of blasting?

Some machines are having this problem and not others? (This would indicate a size control or velocity issue.)

Don't rule out Almen strips....are they all from the same manufacturer? Do you do screen analysis of the shot mix and have new shot additions highly controlled.
What controls are there on pressure and shot flow?

Cast Shot does not work harden more than 1.5 Rockwell points, so it would be difficult to to have a measurable intensity gain. As you know, nozzle wear can change velocities as well. I hope this is helpful.

Gary J
Corpus Christi, Texas
Wow! It is great to hear all this input! Thank you all very much.

With regard to working within the frozen process: We cannot alter the CNC programs because 1) Our programs cannot be changed at all without authorization (even within the ± 10 psi) 2) The frozen process documentation would have to be altered and that requires a lot of red tape. Correct, that frozen plans should not have been made with new shot—I agree 100%. Hind sight is indeed 20/20. I believe this is the root of our problem. With regard to the shot: It is being delivered and screened and checked with the latest technology (computerized everything). The machines have built-in screen classifiers and do an excellent job of keeping the shot free from bad particles. My thinking is that new cast steel shot has numerous pieces with nodules stuck to them, hollow pieces that look like spherical welding slag, and twins. As the pieces impact a work surface the nodules break off, the twins separate, and the pieces work harden, the intensity climbs. Like a baseball covered with clumps of mud not having as much impact energy as a clean ball. The hoppers are stocked with an extra 1-200 lbs at all times so the machine can grab some if it needs it. However, it never grabs more than about 100 lbs at a time so we should never have to worry about too much new shot being added and more conditioning needed.The specs we use all call for cast steel shot and getting the specs changed to anything else is not possible. Yes, we are without any wiggle room as you all can see. We have been forced to alter the frozen plans here and there but that is a process.

Walter
East Hartford, Connecticut
You might find this interesting:
http://www.shotpeener.com/library/pdf/1999090.pdf

Are you working to an OEM specification such as Sikorksy or are you working to DMWR? Is your air pressure tolerance really ±10 PSI? If so that may very well be your problem.
I would suggest you change your air pressure limits to ±10% from nominal across the board on all your machines.

Joe McGreal
Monticello, Iowa
Martinsitic Cast Shot does NOT work harden more than 1.5 HRC. The AMS Range for new shot is 7 HRC points, thus a minimal gain during life isn't a likely cause. Air pressure, size and flow control limits are the reasonable issue here.

Alberto Rodriguez
Corpus Christi Army Depot
Adding small portions of new shot to the existing batch should not have a significant impact in Intensity variation. Even though AMS 2430 and AMS 2431/1 do not cover media conditioning, you are not prevented from having an internal conditioning procedure when a batch is completely replaced with new shot. We will certainly recommend to the committee adding a paragraph to the AMS specs related to this topic. Conditioning of new shot will add quality value and consistency to the process.

Gary J
Corpus Christi, Texas
Thank you for the link, Walter. I did mistakenly say that we were using a ±10 psi range but in fact we are using ±10% on air pressure. The machines maintain a very even pressure and are maintained and tested by the manufacturer. I have no reason to believe that air pressure is the problem. The screens kick out any under/over size pieces and our shot checks always turn out very good. It seems that when our new machines were installed we just did not know about this variable.

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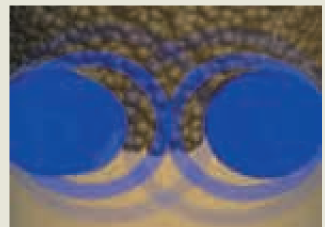

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Peening Indent Dimensions

Dr. David Kirk is a regular contributor to The Shot Peener. Since his retirement, Dr. Kirk has been an Honorary Research Fellow at Coventry University, U.K. and is now Visiting Professor in Materials, Faculty of Engineering and Computing at Coventry University.

INTRODUCTION

Indent size really matters! It has a direct effect on both peening intensity and coverage. Peening intensity is directly proportional to the size of the indents. Coverage increases with indent size (other things being equal). The size of indents is, therefore, of primary importance. Control of indent size depends on knowing (a) the size, (b) the factors affecting size and (c) implementing methods of influencing indent size.

Fig.1 Indent shapes at low coverage.

Typical indents are illustrated in fig.1. The shapes are approximately circular. One indent, highlighted at **A**, has had an 'equivalent circle' created at **B** whose diameter is **d**. Equivalent circles are generally assumed when modeling coverage and indent depth.

This article is a quantitative analysis of the several factors that affect indent size. It is hoped that readers who dislike mathematics will not be put off by the necessary equations that are introduced. Widely-available computer programs, such as Excel, allow such equations to be employed by simply inserting known values. For example, the depth of an indent can be calculated using Excel by entering a known shot diameter into cell A1, a known indent diameter into cell A2 and the following formula into cell A3: =(A1-(A1^2-A2^2)^0.5)/2. This formula is the same as equation (1) presented later.

SHOT SIZE VERSUS INDENT DIAMETER

There is a linear relationship between indent diameter and the diameter of the shot causing the indent – other things being equal. This is confirmed by both actual observation and theoretical analysis. Standard shot peening will produce indents whose diameter is a substantial percentage of that of the shot particles – say 30 to 50%. We can, therefore, predict a standard size range of indents - because we already know the diameter of the shot particles being used.

Fig.2 is a graphical representation of these predicted ranges of indent diameters, **d**, that we might encounter when using cast steel shot of diameter, **D**. SAE nominal shot size has been indicated as this is the most familiar size parameter. It can be seen that there is a huge range of indent diameters that we may come across. A useful 'memory aid', based on assuming that **d** is 40% of **D**, is that:

Indent diameters in microns are roughly the same as the SAE number of the shot being used.

For example, S110 shot produces indents of roughly 110 microns diameter whereas S460 shot commonly produces indents of roughly 460 microns diameter – 1 micron being the same as 1µm.

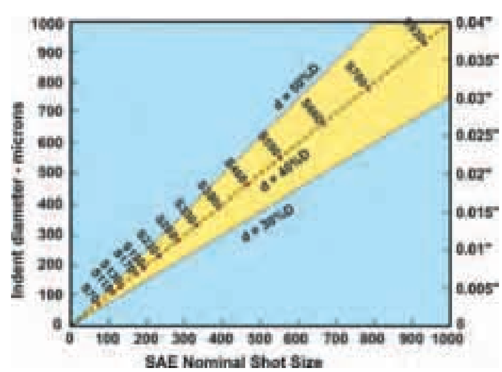

Fig.2 Common range of indent diameters induced using cast steel shot.

INDENT DEPTH, h

Indent depth, **h**, depends on both the shot diameter, **D**, and the indent diameter, **d**. If we assume that the indent is circular and that the shot particle is spherical then the relationship between **h**, **d** and **D** is that:

$$\mathbf{h = [D - (D^2 - d^2)^{0.5}]/2} \qquad (1)$$

where $\mathbf{d < D}$

For example: if **D** = 110μm and **d** = 44μm then **h** = 4.6μm. **h** is then 11% of **d**. Fig.3 is a universal representation of how indent depth varies with indent diameter. **D** is fixed as '100'' so that **h** is then a percentage of **D**. If the indent diameter is 20% of **D** then the depth is only 1% of **D**! Even if the indent diameter is 60% of D then the indent depth is only 10% of **D**. The percentage values for **d/D** as 30, 40 and 60% have also been highlighted.

Automatic calculation of indent depth, **h**, is included in the Excel spreadsheet described in the next section.

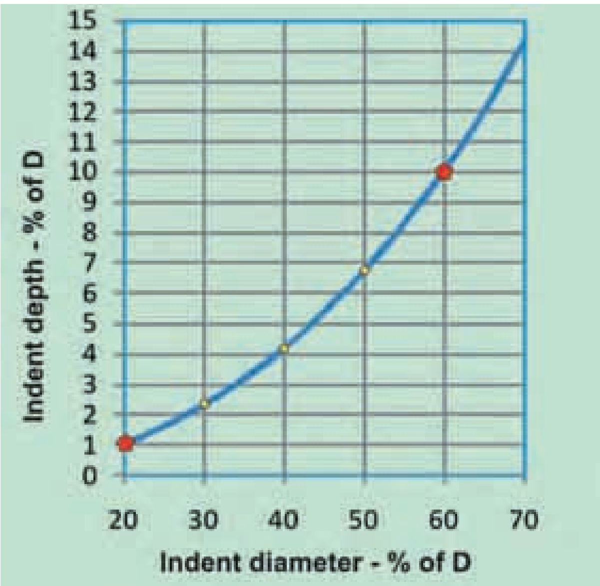

Fig.3 Universal representation of indent depth as a percentage of indent diameter.

PREDICTION OF INDENT DIAMETER AND DEPTH

We can predict the indent diameter and depth that will be induced by shot peening – provided that we know the magnitude of the several controlling factors. These are: **shot diameter**, **velocity** and **density**, together with **component hardness** and **coefficient of restitution**. All of the factors are more or less familiar - with the exception of 'coefficient of restitution'.

Coefficient of restitution is, arguably, the most important parameter in shot peening! It determines how much energy is retained when a shot particle bounces off a component. Imagine a particle being dropped from a certain height, **h1**, onto a flat plate component. It will bounce up to a height, **h2**. The coefficient of restitution, **e**, is given by:

$$\mathbf{e = \sqrt{(h2/h1)}} \qquad (2)$$

If **h2** is half of **h1** then the shot particle has lost half of its energy. **e** is then equal to 0.71. If **h2** equals **h1** (e = 1) then the shot particle has not lost any energy on impact so that no indent could have been produced.

Equation (3) predicts the effects of the several factors controlling indent diameter.

$$\mathbf{d = 0.02284*D*(1 - e^2)^{0.25} * \rho^{0.25} * v^{0.5} / B^{0.25}} \qquad (3)$$

where: ρ is shot density, **v** is shot velocity and **B** is the component's Brinell hardness.

The factor 0.02284 is appropriate when using metric units – **v** in ms^{-1} and ρ in kgm^{-3}.

A	B	C
4	K	0.02284
5	Shot Diameter - mm	0.100
6	Coefficient of Restitution - e	0.71
7	Density - kgm^-3	7860
8	velocity, v - ms^-1	85
9	B.H.N.	300
11		
12	Indent diameter, d - mm	0.040
13	Indent depth, h - mm	0.0042

Fig.4 Spreadsheet for prediction of indent diameter and depth.

Equation (3) is too complicated to visualize quantitatively. A simpler approach is to incorporate that equation into an Excel spreadsheet. The quantitative effect of changing factor magnitudes then appears on simply pressing a button. Such a spreadsheet is shown as fig.4, which also incorporates an indent depth calculation based on equation (1). Known values are entered into the yellow boxes and required answers then appear in the green boxes. The factor **K** is fixed, as is **e** (unless a different, measured, value is available). A value of 0.71 for **e** is reasonable for steel shot bouncing from steel components. Free copies of the spreadsheet are available on request.

The advantages of using a spreadsheet-calculation approach are that the effects of different factor magnitudes can easily be quantified. This is facilitated by having copies of fig.4 side by side on the same spreadsheet. As an example, consider the indents shown in fig.1, which vary in diameter by a factor of approximately 2. Component hardness, coefficient of restitution and shot density are virtually constant (for the given specimen). That only leaves shot diameter and shot velocity as possible causes of indent diameter variation. Using the initial values given in fig.4 the velocity would have to be reduced from $85ms^{-1}$ to $21ms^{-1}$ in order to halve a predicted indent diameter. Shot diameter would only have to be halved (in order to halve the predicted indent diameter). Cast steel shot specifications allow for diameter variations much greater than a factor of 2. It is, therefore, reasonable to argue that the observed indent diameter variation in fig.1 is largely due to shot diameter variation.

EFFECT OF IMPACT ANGLE ON INDENT SHAPE

Shot particles rarely strike a component perpendicularly. In general they strike at some other angle, θ, to the surface - see fig.5 on page 30. Shot stream divergence, component surface curvature and angling of shot stream to the surface all combine to induce values of θ that are less than 90°. The impact angle has an important effect on both peening intensity and indent size. When θ does equal 90° spherical shot will produce a circular indent. If θ is less than 90° the indent will be elliptical.

Fig.6 (on page 30) shows the elliptical indent shape produced by a real shot particle striking a mild steel surface at θ = 45° (travelling from right to left). Mild steel is very useful as a research material because it highlights plastic deformation zones – as on the left of the indentation in fig.6.

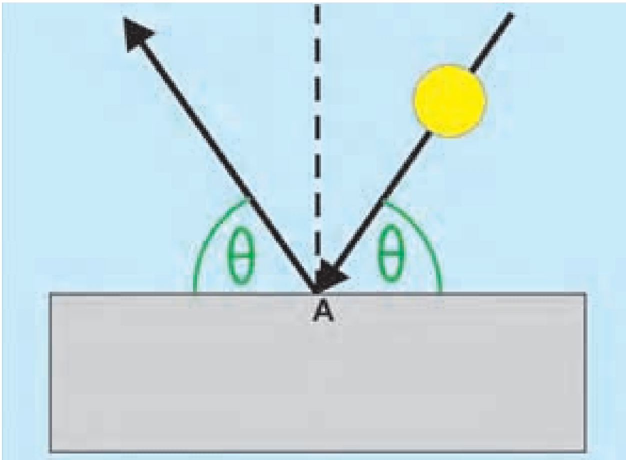

Fig.5 Shot particle destined to impact at A making an angle, θ, with the component surface.

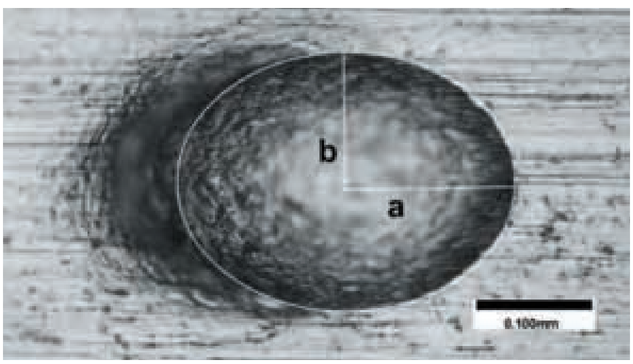

Fig.6 Elliptical indent created by 45˚ impact with a flat mild steel surface.

Ellipticity is defined by the ratio of the major and minor axes, **a/b**. The origin of elliptical indents has been described previously (TSP vol. 19, No.3, 2005).

Effect of Impact Angle on Peening Intensity

Empirical studies have shown that both peening intensity and indent depth vary with impact angle in the same way – as illustrated in fig.7. They are both inversely proportional to $\sin\theta^{1.5}$.

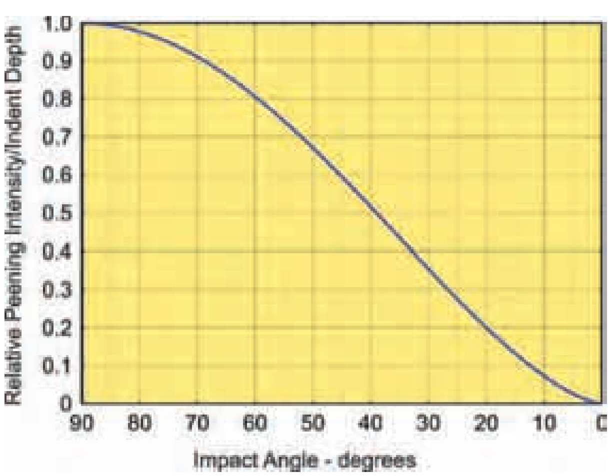

Fig.7 Variation of Peening Intensity and Indent Depth with Impact Angle.

At θ = 60˚, for example, the peening intensity has dropped to 80% of the value that would have been obtained if θ had been 90˚. At 20˚ it is only 20%. This underlines the practical importance of ensuring that the average impact angle is reasonably close to 90˚.

Effect of Impact Angle on Indent Size and Coverage Rate

The size of an indent can be quantified as the flat area defined by its rim. For a circular indent, size is then the area of a circle - $\pi d^2/4$. For an elliptical indent, size is the area of an ellipse – $\pi ab/4$. The empirical studies mentioned previously yield a relationship between impact angle and area of an indent. This relationship is that indent area varies inversely with sinθ – as shown in fig.8. Relative coverage rate varies inversely with $\sin^2\theta$ – because a given shot stream is striking a larger area as θ decreases.

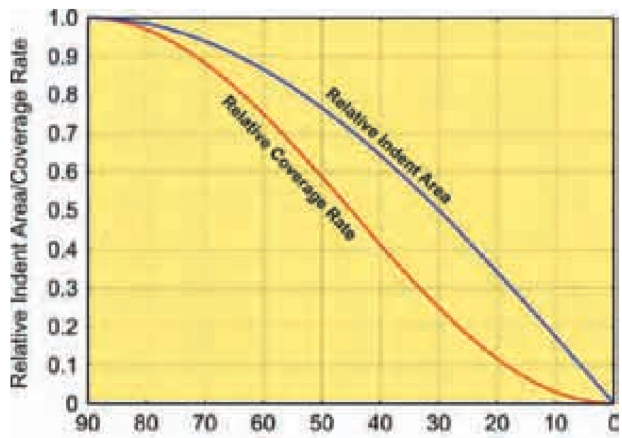

Fig.8 Effect of Impact Angle on Indent Size and Coverage Rate.

The fall in coverage rate with decrease in impact angle is even greater than the fall in peening intensity. Again we have a practical significance – the time for attaining a given coverage percentage will strongly depend on the impact angle.

INDENT VOLUME

Having either estimated or measured the diameter and depth of an indent we can then estimate its volume. Indent volume, v, for a circular indent is given by:

$$v = (\pi/6)(3d^2/4 + h^2)h \qquad (4)$$

Indent volume is important because it represents the amount of work that has been done by the impacting particle on the work piece. The impacting particle has a kinetic energy, $\frac{1}{2}mv^2$, as it impacts the surface. It follows that the greater the particle's kinetic energy the greater will be the volume of the indent produced.

MEASUREMENT OF INDENT DIAMETERS

Peening indents are very small - some 10 to 1000 microns - so that image magnification is essential for accurate measurement. Magnification can either be simply optical or a combination of optical and digital.

We can measure indent diameters either directly - using an optical image - or indirectly - using a digital

image. Direct measurements involving a measuring microscope are probably the more accurate. Each human eye has about 125 million rods to detect black-and-white and 7 million cones to detect color. Using two eyes we also have the benefit of stereoscopic vision. A typical digital camera has only about 10 million pixels.

There is a wide range of available measuring techniques each of which has advantages and disadvantages. Every technique relies, however, on a 'graticule'. A graticule is a form of miniature ruler made by using precision engineering to inscribe finely-spaced lines on either a metal or glass plate. A typical graticule is illustrated in fig.9 where one millimeter has been divided into 100 segments.

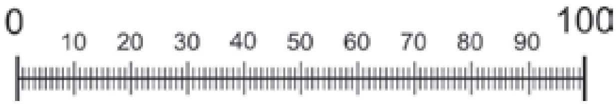

Fig.9 Metric graticule with one millimeter divided into a hundred parts.

Two of the author's favorite techniques are based on using either a measuring microscope or a USB microscope. Fig.10 is a flow chart summarizing the differences between the techniques.

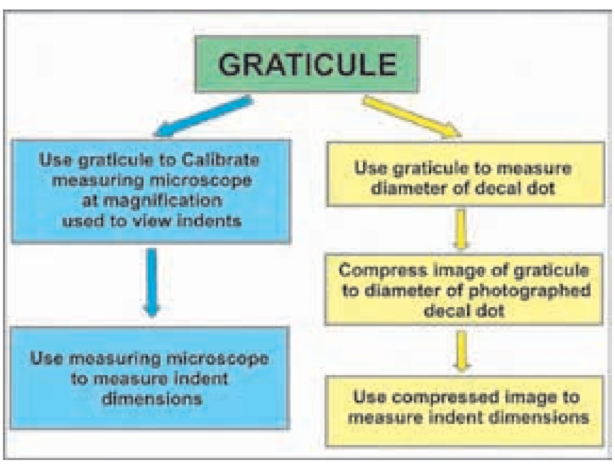

Fig.10 Indent dimension measurement - either directly or indirectly.

Measuring Microscope

The use of a microscope equipped with a measuring eyepiece is well-established and well-documented. Essentially the scale of the measuring microscope is calibrated against a graticule. The scale, calibrated at the magnification to be used for indent examination, can then be used for direct indent dimension measurement. This method is probably the most accurate and reliable of the several available techniques. Its major drawback is a lack of portability so that it has limited application for on-site examination of large components.

USB Microscope

USB microscopes have evolved to a stage where they are sufficiently accurate for indent measurements. When attached to a 'universal clamp', they can easily be focused on peened areas of actual components. A significant problem, however, is posed by the necessary calibration

Fig.11 Decal black dot on self-adhesive yellow label stuck to peened component.

procedure. One solution, employed by the author, is illustrated by fig. 11.

Decal black dots (from a dry-lettering range) are manufactured with a high degree of precision. Their diameters can be pre-checked using a graticule and a measuring microscope. One or more dots are rubbed onto a self-adhesive label which is then placed adjacent to the peened area to be photographed. Having selected an appropriate magnification, the dot and peened surface are then photographed - either concurrently or consecutively. The decal dot diameter of fig.11 is 0.450 mm (established using the measuring microscope method). This known diameter is then used as an 'on-screen' reference when examining images on a computer screen. One technique is to compress an image of a 0 - 100 graticule until it is the same length as the diameter of the photographed decal dot. This compressed image is then moved over an indent to effect measurement.

SUMMARY

The diameter, d, of the indent produced by a shot particle can be predicted using equation (3) and hence its area $(\pi d^2/4)$. Indent depth can be predicted by using equation (1). These predictions require a knowledge of several shot peening parameters. Shot velocity is not commonly measured directly but can be predicted, for either air-blast or wheel-blast systems, using equations presented previously (TSP volume 21, Nos. 1 and 2, 2007). Observed indent size changes can be related to changes in either operating conditions or component properties.

Indent depth is directly related to the peening intensity that is being used - for a given shot size. There is a current belief that peening intensity depends only on the diameter of indents induced in Almen strips and is independent of the shot diameter being used. For any given indent diameter its depth decreases rapidly with increase of shot diameter - as shown by equation (1). This raises fundamental questions about corresponding depths of plastic deformation. There is an urgent need for experimental verification of the stated belief.

Average indent area, **A**, is one of the three factors that govern coverage, **C**. The others are the rate of indenting, **R**, (number of indents per unit area per unit time) and time

of peening, **t**. Equation (5) gives the established connection between the three parameters.

$$C = 100(1 - \exp(-A.R.t)) \quad (5)$$

It follows that average indent diameter is a prime controlling coverage. Computer programs have been produced that allow predictions to be made of both coverage and indent diameter. One example was presented at ICSP6 by Lombardo. All such programs (and the equations presented in this article) are, however, based on modeling of the peening process. This means that, however useful they may be, they cannot be guaranteed to be precise. ●


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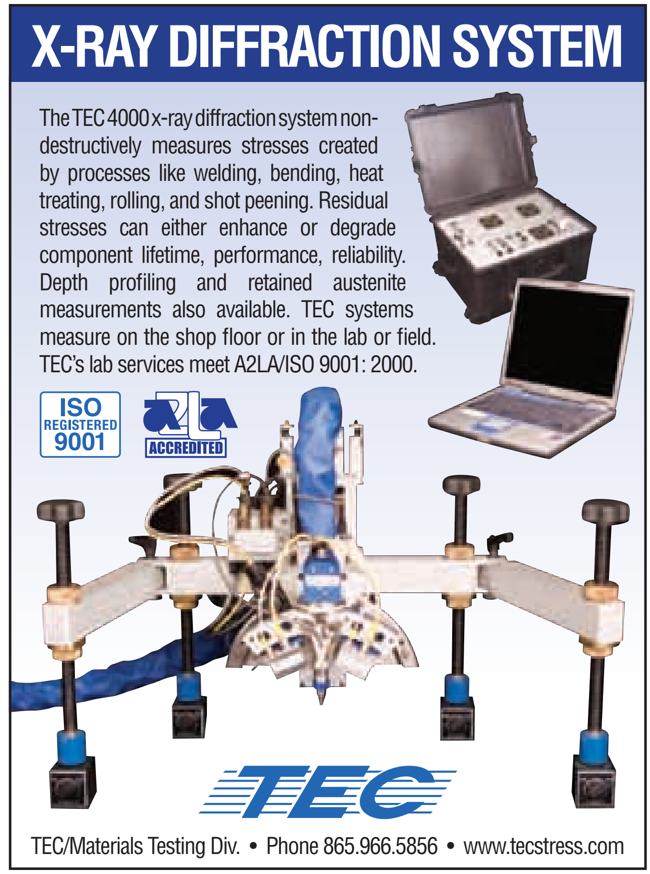
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Blasting, Peening, and Finishing Efficiences Rely on Proper Nozzle Selection

Got a question about shot peening, abrasive blasting, or sample processing? Herb can help.

Call Herb Tobben at 636-239-8172 or submit your request online at www.clemcoindustries.com. Herb Tobben is Sample Processing Manager for the ZERO and AEROLYTE brands of Clemco Industries Corp., Washington, Missouri. He is a speaker at the EI Shot Peening Workshops.

To speed production and to ensure conformity to specification, most companies with high volume parts processing requirements choose automated blasting. An automated blasting, peening, or finishing operation offers consistent, repeatable results. Repeatability is the value proposition in a successful operation.

Achieving repeatability depends upon delivering a uniform quantity of media at a consistent velocity and striking the target surface area in the same way each and every time. Whether or not results are monitored and measured, as they need to be with shot peening, the operation for blast cleaning and finishing applications demands similar adherence to proper procedure for the best results.

Pressure blasting is chosen for some high-production air-powered processes because it propels media at a higher velocity through the blast nozzle than suction blasting. In air-powered pressure blasting, media feeds from a pressure vessel into a moving stream of compressed air through a metering valve, blast hose, and nozzle.

Perhaps the most critical component for reaching production goals is the nozzle chosen for the job. With the help of its internal shape, the nozzle distributes the media as needed for the application. Two types of pressure blast nozzles are generally used. They are designed with unique internal shapes to achieve different objectives. Both types have a broad entry area, which sharply tapers to an orifice—the smallest inside diameter (ID) of the nozzle and, in fact, the smallest point in the entire blast system. The rapid reduction in ID and the controlled expansion of the compressed air, moving through the nozzle, work together to accelerate the media toward their target.

As its name indicates, a straight-barrel nozzle has a straight, constant-diameter barrel, the point between the orifice and the exit-end of the nozzle. When the air and media reach the nozzle exit, the less-dense air quickly expands once the influence of the nozzle barrel is absent, and momentum carries the media along the center of the blast pattern. The straight-barrel shape creates a relatively small blast pattern with a very high intensity tapering out to lower impact at the perimeter. While it takes longer to cover a large surface area with such a small hot spot of higher intensity compared with other nozzle shapes, the straight-barrel shape works well in recessed or restricted areas.

Unlike the straight-barrel nozzle, the venturi nozzle gradually tapers outward from the orifice to the exit-end of the nozzle. This gradual exit expansion allows a mixing of air and media within the nozzle causing them to expand uniformly before leaving the nozzle. A venturi nozzle provides excellent peening intensity and cleaning capability with a broad pattern. The performance of the venturi nozzle depends on a precise ratio of length to orifice size, and to entry and exit tapers. This design creates a large blast pattern that produces uniform peening intensity and maximum acceleration for cleaning.

As pressure-blast nozzles wear from continuous exposure to high-velocity media, more air and media are allowed to pass through the orifice. The resulting larger area within the nozzle consumes more air volume placing greater demand on the compressed air source. Unless air volume can keep up with the increased flow, pressure at the nozzle will drop. With reduced pressure, peening intensity and productivity fall, and efficiency suffers. A rule of thumb to follow for ensuring continuous high production is to replace the nozzle when the orifice wears to the next larger size. Generally, that means 1/16" or 1.5 mm. In the USA, nozzle sizes are measured in 1/16" increments. A No. 6 nozzle has an orifice of 6/16" (3/8"); the next larger size is No. 7 with an orifice of 7/16" (11 mm). In Europe and elsewhere, nozzle sizes are indicated in millimeters.


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The relative life expectancy of a nozzle depends upon the combination of liner material and abrasive/media. The harder the media, the more durable the liner material must be to withstand exposure to it over an acceptable life. A commonly employed industry reference is the Mohs' scale, which offers a method of measuring relative hardness, on a scale from 1 to 10, in non-metallic media and nozzle liner materials. Metallic media (steel) is measured on the Rockwell scale. Common steel media range from soft Rc-35 to hard Rc-65.

Table 1 shows the relative hardness* on the Mohs' scale for common media and nozzle liner materials. *On the Mohs' scale, 1=talc; 10=diamond

Table 2 shows the relative life expectancy for the three most popular nozzle liner materials with steel media.

As critical as are the choices of nozzle shape and liner material, distance between the nozzle and the target object greatly affects the overall productivity of the blast cleaning, finishing, and peening processes. For efficiency in cleaning and finishing, and to adhere to strict peening intensity specifications, the target area must be covered with precision. Overlapping coverage wastes valuable resources in cleaning and finishing, and may not produce specified results in peening applications. With the relatively larger pattern produced by the venturi nozzle, it is important to be able to calculate the area the blast will cover.

Calculating the blast pattern size is easy; simply multiply 0.125 times the distance between its exit end and the target surface, and add the ID size of the nozzle orifice. For example: the pattern size produced by a 3/8" (9.5mm) nozzle positioned 8 inches (203.2 mm) from the surface is 1.375 inches (34.9mm).

Once calculated, the area covered by the chosen nozzle(s) is determined, leading to further decisions regarding precisely what system configuration (i.e. number of nozzles needed) will do the job in the desired timeframe and within the defined budget.

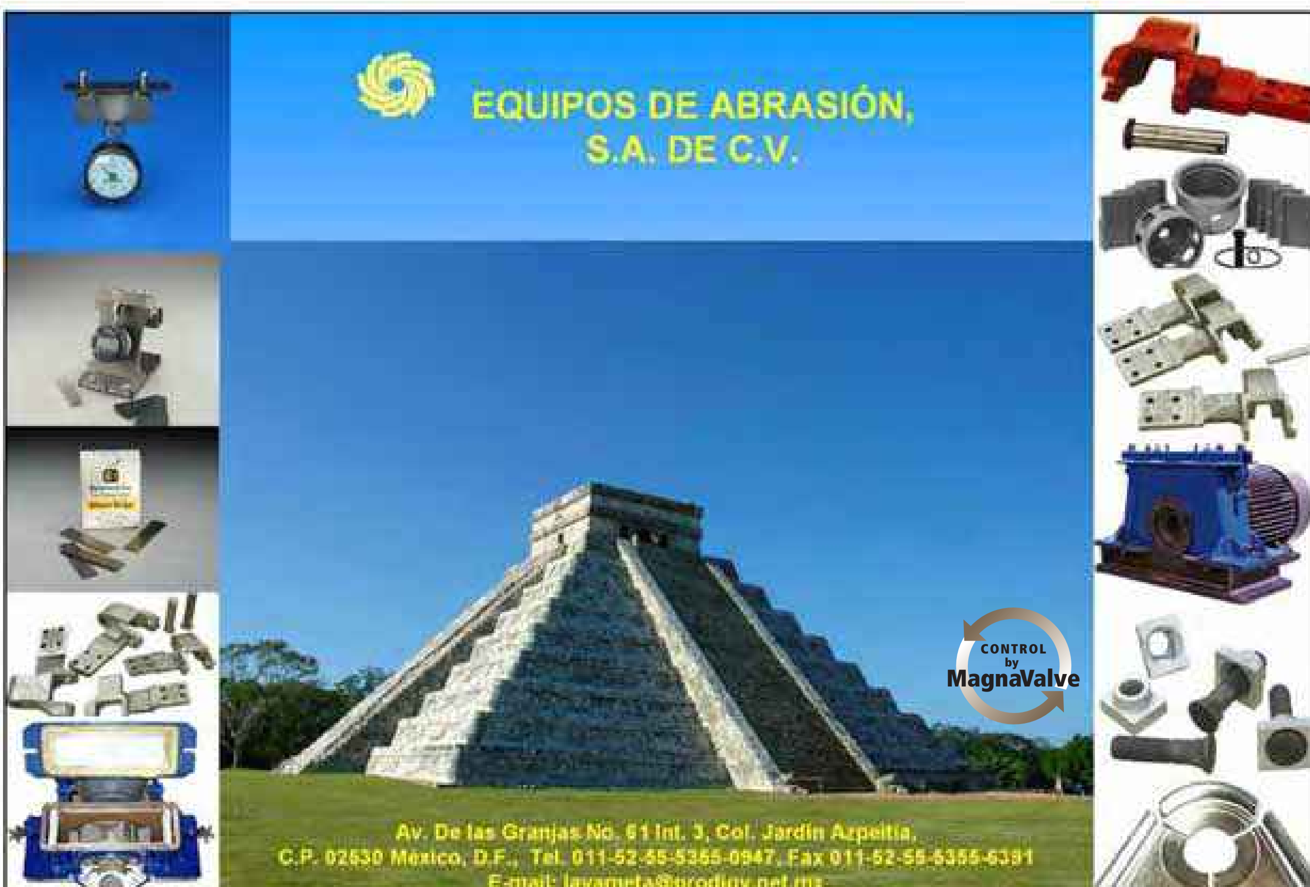
For more information about how proper nozzle selection and maintenance can keep your shot peening operation operating at peak performance, sign up for the Fall EI Shot Peening Workshop in St. Louis and sit in on my nozzle session.

Table 1: Comparative Media and Nozzle Liner Hardness

Material	Relative Hardness*	Common Material / Nozzle Liners	Common Material / Blast Media
Plastic	2.8 - 4.0		x
Glass Beads	5.5 - 6.0		x
Garnet	7.0		x
Quartz	7.0		x
Ceramic	7.0 - 8.0	x	x
Steel Grit or Shot	6.0 - 8.0	x	x
Tungsten Carbide	8.5 - 9.0	x	
Aluminum Oxide	9.0		x
Silicon Carbide	9.5	x	x
Boron Carbide	9.9	x	

Table 2: Estimated Life Expectancy with Steel Media

Nozzle Liner Material	Nozzle Life (Hours)
Tungsten Carbide	400 - 700
Silicon Carbide	500 - 800
Boron Carbide	1,000 - 1,500



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Industry News

HAAS & Rösler – Orthopaedic Implant Alliance

The German companies HAAS Schleifmaschinen GmbH, based in Trossingen, and Rösler Oberflächentechnik GmbH, based in Untermerzbach, combine their know how in the field of orthopaedic implants

Untermerzbach, Germany. Thanks to the innovative equipment and manufacturing technologies developed by the grinding specialist Haas, high-precision grinding and milling have become the standard manufacturing method for forming the final shape of orthopaedic knee and hip implants. At the same time, the surface finishing specialists at Rösler adapted and refined existing drag-finishing technologies to provide the final surface finish on the implants. By combining the technologies of the two specialists, it has become possible to create high-quality finished products from raw castings or forgings.

Since younger people are putting a lot of stress on their joints by extreme sports and the life expectancy is increasing all over the world, the demand for artificial joints has been growing rapidly. Due to the fact that these products are implanted into the human body, they are subject to stringent requirements with regard to repeatability and accuracy of the manufacturing process. For this reason the two partners have one common objective; namely the development of a precise and repeatable process technology for placing the final finish on the surface of implants.

The detailed technical coordination between the two specialist partners helps customers to exactly define their product and manufacturing parameters during the planning phase. This saves time and provides an early overview of the most important issues like cost calculations and specification of the manufacturing environment. Leading global players in the field of engineered medical products are already taking advantage of the combined know-how provided by Haas Schleiftechnik and Rösler for the final surface finish of the implants.

The technical combination of high precision grinding and high-end surface finishing offers optimal technical solutions for the implant manufacturers and their manufacturing processes. In 2010 Haas and Rösler will jointly present their respective technologies at various trade fairs including GrindTec in Augsburg.

Photo: Rösler Oberflächentechnik GmbH

Haas and Rösler offer an optimum combination of the complete product shaping process, from profile grinding, milling, and all the way to fine grinding and polishing.

Jack Champaigne Receives Outstanding Contribution Award by SAE International

Mishawaka, Indiana. Jack Champaigne, President of Electronics Inc. (EI), received an Outstanding Contribution Award by SAE International at the 2010 SAE World Congress in Detroit this April. Established in 1953, the annual award recognizes outstanding service and leadership in the technical standard boards of this organization for engineering professionals in automotive, aerospace and commercial vehicle fields.

Mr. Champaigne has been a member of the SAE International Materials, Processes and Parts Council since 1986 and currently serves as Committee Chairman of the SAE Surface Enhancement Committee. The Surface Enhancement Committee is responsible for developing and revising surface treatment standards used in the manufacture of metal components. Under Mr. Champaigne's leadership, the committee has updated and created metal surface treatment standards that address rapid advances in technology and special applications for the automotive industry.

EI manufactures and distributes products that improve the quality and control of shot peening. "Mr. Champaigne's experience and thorough understanding of shot peening specifications is an invaluable asset to EI," says Tom Brickley, EI's Vice President. "His expertise has enabled EI to develop products that help manufacturers meet, or exceed, SAE shot peening standards."

Online Buyer's Guide Hits 600

Mishawaka, Indiana. When Allied Mechanical Contractors added their listing to the Buyer's Guide at www.shotpeener.com, they became the 600th company in the largest online Buyer's Guide for the shot peening / surface finishing industry. Visitors can search the guide by product type or company name. Each listing has the company's address, phone number(s), products and/or services. As an added convenience, the digital listing lets you send an email or click to the company's web site from the listing page.

Best of all, inclusion in the Buyer's Guide is a FREE service of www.shotpeener.com—there is no charge to place a listing or search the guide. Take advantage of it today!

Compact, Robotic Air-Blast System Facilitates Leaner Cell Manufacturing

Langhorne, Pennsylvania. A compact, automated air-blast system combining pressure-blast productivity with the robotic precision demanded by producers of aerospace and medical equipment is now available from Empire Abrasive Equipment Company, a leader in air-blast technology.

Designed for lean cell manufacturing, these PRobot™ systems require only 46 square feet of floor space and under 8 feet of headroom. In addition, these fully integrated systems move easily from one cell to another via forklift or overhead crane. With only two connections — compressed air and electricity —the PRobot gets to work in a new cell. In addition, a user-friendly mobile interface enables programming of all operating parameters from a single station.

Roof mounting of a six-axis robot within the system's 67-cubic-foot blast enclosure opens the work envelope to a full 360° and, in some cases, eliminates the need and cost for a seventh axis, such as a servo-powered turntable.

Empire welcomes prospective users of the PRobot to visit its newly expanded testing and demonstration laboratory in Langhorne, Pennsylvania, USA, where the company test blasts customer parts and shows a large selection of its equipment, including the PRobot, in action. To arrange a visit or find out more, please use the following communication links: Empire Abrasive Equipment Co., 2101 W. Cabot Boulevard, Langhorne, PA 19047 Telephone: 215-752-8800, Fax: 215-752-9373, Email: Air-blast@empire-airblast.com, Web address: www.empire-airblast.com

P4S - Partners for Steel – Cooperation of the Specialists in Sawing, Drilling and Shot Blasting

Untermerzbach, Germany. Three industry leaders have partnered to provide their combined know-how to steel fabricators and distributors worldwide.

Vernet Behringer, an innovative manufacturer of dedicated production lines for the steel industry, **Behringer GmbH**, one of the world leaders in sawing solutions, and **Rösler Oberflächentechnik GmbH**, the world's leading manufacturer of surface finishing technology including preservation lines, have allied their competencies to provide turnkey installations that combine machining, sawing and shot blasting equipment. Worldwide, 1,700 employees are committed to serve end users through a close meshed network of local offices and external sales agencies. The three companies will continue to produce and distribute their own products.

High-precision sawing technologies combined with high performance machining lines are the core competencies of Behringer and Vernet Behringer. By linking these systems with Rösler shot blasting equipment, they can thus offer complete turn-key lines with optimized production flows and avoiding common interface problems that occur with other vendors.

PARTNERS FOR STEEL

From the early phases of the project, the common technical approach ensures an optimal engineering in terms of earnings, productivity and quality for the best possible return on investment. Major players in the steel industry already trust these specialists.

Rösler, Behringer and Vernet Behringer will participate at many different 2010 exhibitions. Please find more information on this topic under www.partners4steel.com.

New Paper on Manual Shot Peening Available in www.shotpeener.com Online Library

Mishawaka, Indiana. The Society of Experimental Mechanics Inc. has granted "The Shot Peener" magazine permission to post a paper from the Proceedings of the 2009 SEM Annual Conference & Exposition on Experimental & Applied Mechanics. The Abstract and Introduction are published below and the complete paper is available in the online library at www.shotpeener.con/library.

Effects of Manual Shot Peening Conditions on High Cycle Fatigue

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Abstract
In the manual peening operation, the control of intensity and coverage is of vital importance to maintain quality assurance. This experimental investigation provides information to establish an optimal manual shot peening condition and develop a relationship between the fatigue life and peening process parameters such as coverage, saturation and intensity. Observations showed that the peening process is strongly dependent on the control of peening conditions in manual operation. The results of this work show that with proper controls, manual shot peening can be used to produce an optimum balance between surface hardening and surface roughness. Based on the results, the investigation evaluates the fatigue performance of manually peened 7050-T7451 aluminum alloy under high cycle loading.

Introduction
There are many processes used today to treat the surface of metals. Cold working of the surface of materials is a widely used method that has been around for centuries and shot peening is one of the many methods of this type of surface treatment [1-5]. Although the mechanism of shot peening is a simple concept, the process is complex. Shot peening produces several changes in the workpiece material, including changes to microstructure, residual stresses, and topography. Some of these changes are beneficial, and some are potentially detrimental [6-9]. However, the effectiveness of the shot peening process is dependent upon the uniformity of the induced compressive residual stresses and the energy transfer that occurs during the impact of the shot with the target surface. Although modern day shot peening is mostly a highly controlled, automated process, due to component shape and/or size in real world applications, it needs to employ manual shot peening treatment to induce the compressive residual stress in certain situations [3]. In manual peening operations, the control of intensity and coverage is of vital importance to maintain quality assurance [4]. In practice, process efficiency is established by means of coverage, intensity and saturation. Intensity and saturation can be found for varying input conditions. These are stand off distance (SOD), impingement angle, air pressure, shot size, shot properties and material properties. There is a need to understand the relationship between peening parameters and intensity. Limited manual peening studies and their impact on components have been published and there exists a real need for a much more extensive study to cover all the aspects that make for optimizing the manual peening process [10]. The purpose of this paper is to investigate manual shot peening process parameters (intensity and coverage) and also to evaluate the fatigue performance of manually peened 7050-T7451 aluminum alloy under high cycle loading.

TOYO SEIKO Introduces New Portable Coverage Measurement Device

Yatomi-city, Aichi, Japan. COVERAGE CHECKER™, a device that can measure coverage on site, has been developed by TOYO SEIKO Co., Ltd. With a pocket-sized camera and telecentric system, it is designed as a handheld system. To correlate with visual inspection, data tables are prepared and suitable measurement conditions are designed to adjust each application for users.

Fig.1 Device component (prototype)

COVERAGE CHECKER™ binarizes obtained pictures to find coverage percentage. The measuring area is 0.14" long by 0.19" wide as a maximum. There are two algorithms, one is simple binarization and the other uses a differential function. As a characteristic, coverage percentage on a curved surface could be measured. Curved surface of dia 0.3" could be measured correctly by the prototype shown in Fig. 1.

The following is a coverage measurement on dia 0.3" round bar of austenitic stainless steel. The round bar was shot peened with CW-28, and the coverage percentage of 50, 70, 90, 98% area were obtained by the visual inspection. Then with COVERAGE CHECKER™, coverage percentages were measured five times at each area and average and single deviation were calculated. The results of COVERAGE CHECKER™ correlate closely with visual inspection, as shown in Table 1. The photograph of the dia 0.3" round bar used to measure the coverage is shown in Fig. 2.

Table 1 Measurement results on dia 0.3" round bar

Visual coverage [%]	Measurement results by COVERAGE CHECKER™						
	1	2	3	4	5	AVG.	
98	100	100	97	100	94	98.2	2.7
90	90	90	89	94	92	91.0	2.0
70	72	66	68	74	74	70.8	3.6
50	50	50	44	53	51	49.6	3.4

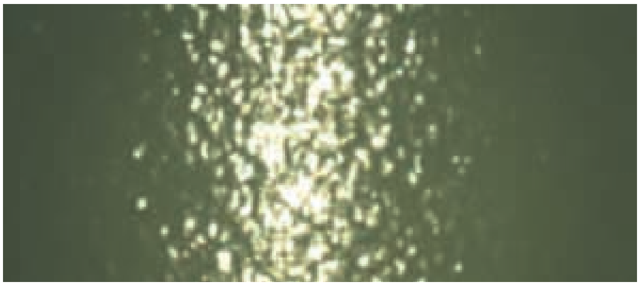

Fig. 2 A photograph of dia 0.3" round bar taken by COVERAGE CHECKER™

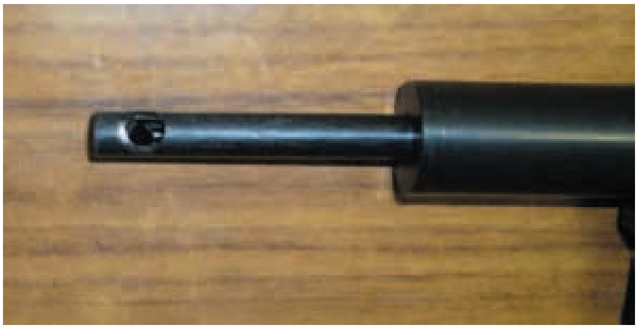

Fig. 3 A special tool for bore

COVERAGE CHECKER™ can measure coverage inside a dia 0.5" hole with the special tool shown in Fig. 3. The dia 0.5" bore of austenitic stainless steel was shot peened with CW-28, and the coverage percentage of 30, 75, 90, 98% area were obtained by the visual inspection. Then with the COVERAGE CHECKER™, coverage percentages were measured five times at each area then average and single deviation were calculated. The results were shown in Table 2. The results of COVERAGE CHECKER™ also closely correlate with visual inspection.

Table 2 Measurement results on dia 0.5" bore

Visual coverage [%]	Measurement results by COVERAGE CHECKER™						
	1	2	3	4	5	AVG.	
98	95	95	99	97	95	96.2	1.8
90	91	90	86	89	89	89.0	1.9
75	77	72	76	71	69	73.0	3.4
30	31	27	28	24	27	27.4	2.5

2010 SAE Congress Returning to our Roots

"The SAE World Congress, an annual gathering of thousands of automotive engineers, is reinventing itself, like the auto industry," wrote David Shepardson with *The Detroit News*.

The atmosphere at the recent SAE Annual Exhibition at COBO Hall in Detroit was electric—the number of automotive industry exhibitors with electric themes was the most we've ever seen.

During the horsepower wars of the 1950s and 60s, auto engineers were more than happy to provide enough energy to push the biggest of the gas guzzlers to amazing speeds. Those days are over. More than a century after the first electric vehicles were replaced with cars with gasoline engines, automotive engineers are facing problems and opportunities associated with today's electric vehicles and other energy-saving technologies.

Does this mean less shot peening since the gasoline engine is fading into history? Not by a long shot (pun intended). If saving weight was important in automotive design before, it is even more important now.

Recall that our industry was started primarily because of the fatigue failures of engine valve springs. Engineering work of John Almen at the Research Division of Buick Motor Division of General Motors led to the adoption of "shot blasting" to dramatically increase the fatigue strength and life of valve springs.

Andrew Brown, Jr., 2010 President SAE International, presented the 2010 Technical Standards Board Outstanding Contribution Award to Jack Champaigne at the SAE Awards Ceremony.

It didn't take long to add numerous items to the list of shot-peened components including crankshafts, camshafts, gears, drive shafts, torsion springs, leaf springs, and the list goes on and on. Any metallic component subjected to cyclic loading can benefit from shot peening to extend its fatigue life.

Additionally, springs, drive shafts, gears, welds, and many more components can be made lighter and stronger by the application of shot peening. The energy storage currently available (no pun intended here) in electric cars is meager. This means that anything that can be done to reduce weight is of utmost urgency. That's why shot peening will come to the rescue, again.

Did you know?

Woods Phaeton invented the first hybrid car in 1916 with both a internal combustion engine and an electric motor.

The decline of the early electric vehicle was brought about by several major developments:

- **By the 1920s, America had a better system of roads that now connected cities, bringing with it the need for longer-range vehicles.**
- **The discovery of Texas crude oil reduced the price of gasoline so that it was affordable to the average consumer.**
- **The invention of the electric starter by Charles Kettering in 1912 eliminated the need for the hand crank.**
- **The initiation of mass production of internal combustion engine vehicles by Henry Ford made these vehicles widely available and affordable in the $500 to $1,000 price range. By contrast, the price of the less efficiently produced electric vehicles continued to rise. In 1912, an electric roadster sold for $1,750, while a gasoline car sold for $650.**

Resource: http:// inventors.about.com