Media Selection For Micro Blasting Medical Parts

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Micro blasting is used in a range of applications including catheter, stent and pacemaker manufacturing. The correct media to use for the required surface is defined here together with some of the finer points of the process to ensure successful results.

Choosing the correct media

Micro abrasive blasting, often described as miniature or precision sandblasting, is a process with a wide range of uses in the manufacture of medical parts. In this process, small abrasives, typically 10–100 µm in size such as aluminium oxide, glass beads, silicon carbide and sodium bicarbonate are used. The different media available, together with variances in pressure, nozzle size and powder flow yield a range of results from lightly textured surface to a cut completely through the material.

The media chosen for a specific micro abrasive blasting application depends on physical properties of shape, hardness and particle size. Particles that are angular and make sharp cuts strip away material on impact; spherical ones pound or peen a surface. Harder particles are more aggressive at removing material. Larger particles generate a greater impact and remove material faster and produce a heavier textured or roughened surface on the base material. The media selection guide in Table I shows the appropriate media for a range of applications.

Soft abrasives for texturing and deburring

Most polymer materials used in catheters are extruded to give them high lubricity. To better bond a balloon, metal tube or other component to polymer material, the surface should be lightly abraded to improve adhesion. A soft abrasive such as sodium bicarbonate is recommended for this because it creates sufficient texturing without damaging the catheter tube.

Sodium bicarbonate is also used to lightly deburr precision ground →

Figure 1: Cannulae are blasted with glass beads at a 90° angle to remove burrs.

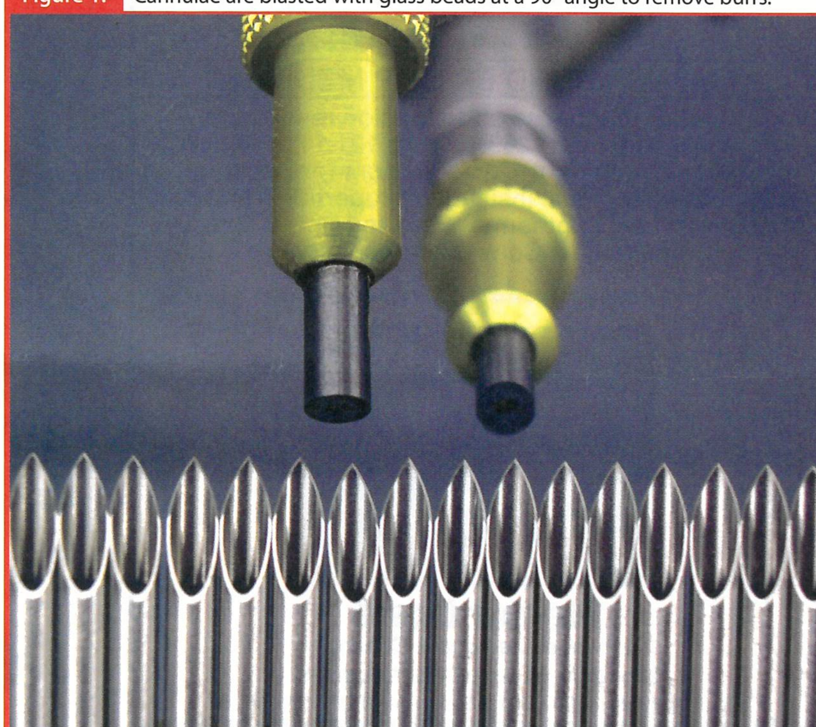
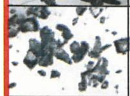


Table I: Guide to media selection.

Media		Particle size range (micron)	Particle shape	Hardness (Mohs)	Common applications
	Aluminium oxide	10–150	Angular and sharp	9	• Deburring stents • Indication band texturing
	Crushed glass	50	Angular and sharp	5–6	• Removing the coating on guidewires • Texturing moulds
	Glass beads	35–50	Spherical	6	• Removing the coating on guidewires • Texturing moulds • Deburring cannulae • Creating a satin finish on pacemaker cans
	Plastic media	200	Angular	2–4	• Conformal coating removal
	Silicon carbide	20–50	Angular and sharp	–	• Deburring stents
	Sodium bicarbonate	50	Monoclinic	–	• Texturing catheters • Removing the coating on guidewires • Refurbishing surgical tools • Texturing moulds • Removing silicone covering on defibrillator leads
	Walnut shell	250	Angular	3–4	• Conformal coating removal • Deflashing plastic parts

sharpened surfaces. It removes small burrs formed during the grinding process on surgical cutting tools without damaging the cutting surface. In addition to the manufacture of surgical tools, micro blasting is used to refurbish tools for reuse. The small nozzles allow the operator to reach into tight crevices to remove debris. Here, too, sodium bicarbonate is the media of choice because of its ability to effectively clean off the residue without damaging the tool.

Beads for a satin finish

Micro blasting with two different abrasives is common in the manufacture of pacemaker cans. Sodium bicarbonate is used to remove excess epoxy residue from where the header is bonded to the can. Glass beads are used on the can to clean up the laser weld before it is polished or has a coating applied. Pacemaker cans are susceptible to injury and as with most medical parts, a cosmetic surface finish is desired. Therefore, after the epoxy has been removed and the laser weld cleaned, the entire can is blasted with glass beads to clean off any irregularities or scratches. The spherical shape of the glass beads prevents them from cutting into the surface; it pounds the surface to create an attractive satin finish.

Hypodermic needles are ground to create the sharp tip. The grinding process creates a sharp edge around the entire end of the needle. To prevent the needle from cutting a core when inserted, the heel must be radiused. The grinding process also typically leaves a burr at the heel that must be removed. To do this, cannulae are lined in a row and blasted with glass beads at an angle of 90° (Figure 1). Glass beads work well at rounding the edge and removing the burr without altering the exacting tube tolerances.

Hard abrasives for cutting

The manufacture of Nitinol stents starts with laser cutting an intricate pattern into a small tube. The laser cutting process leaves an oxide layer on the surface of the stent and remelt on the sides of the struts. Left untreated, these imperfections will adversely affect the performance and the lifespan of the device. Micro blasting can remove the oxide layer and the remelt. The sharp cutting ability of aluminium oxide makes it an ideal choice for stent surface engineering; 17.5 μm particles are typically used. Silicon carbide, which is more aggressive, is another common choice. Abrasive selection is dependent on the amount of residue or burrs to be removed.

Stent surface engineering is typically automated at the production level. Because too much abrasion will weaken the joints and cause premature device failure, automated systems are commonly used to control results. The weight in thousandths of a gram that is removed from the stent may be used to measure results (Figure 2).

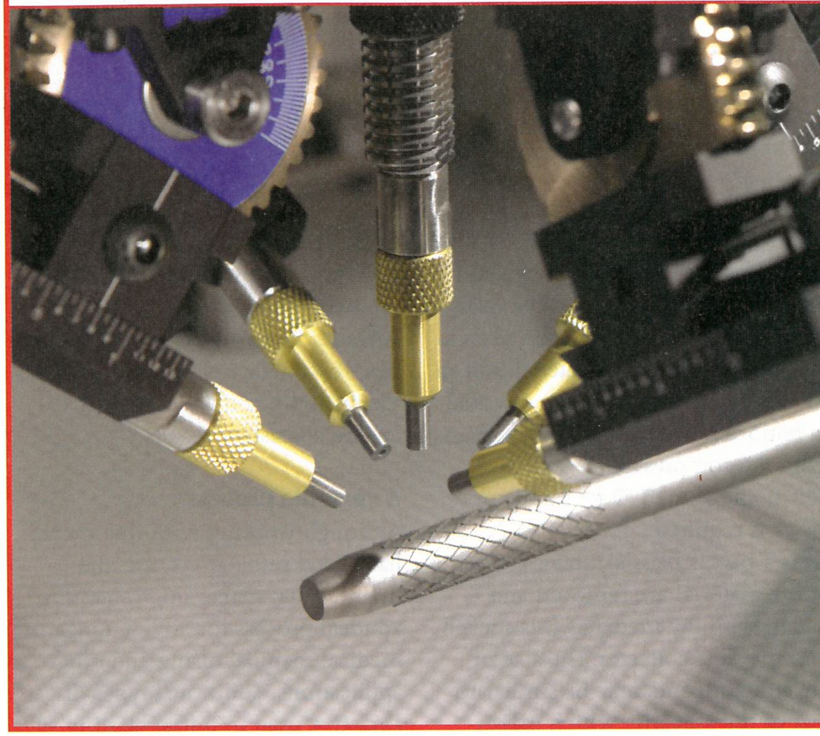
Micro blasting media issues

Using the fine media outlined above does entail some additional considerations. The abrasive media is only able to be used once. Recycling is impossible because three changes occur: the breakdown of particles, absorption of moisture and contamination.

Typical cutting abrasives such as aluminum oxide and silicon carbide are hard with sharp edges. This also tends to make them brittle so that they fracture on striking the part. As a result, the spent media consists of smaller particles and extremely fine powder. The change in particle size distribution causes the cutting force of the particles to change. It becomes impossible to maintain a consistent, reliable blast process when the abrasive characteristics change dramatically.

Dry media and dry, clean air is essential to prevent the powder from clumping and causing clogs. Particles blasted into the ambient environment absorb moisture as they are pulled from the workstation and into the dust collector. When working with nozzles →

Figure 2: Micro blasting can remove the oxide layer and the remelt on the sides of the struts of Nitinol stents.



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as small as 0.018 in. (0.5 mm), even a small clump of powder could easily disrupt the flow. Care must be taken to properly store abrasive material, and an air dryer with an oil filter is essential to remove moisture and contaminants from the compressed air source. A dew point of −25 °F (−32 °C) or lower is required.

As a part is blasted, small pieces of the material are removed and mixed with the media as it is sucked into the dust collector. The size of the contaminants may be similar to that of the abrasive, which makes it virtually impossible to separate the two. The substrate material and abrasive media have different properties; reuse will yield different results. Virgin abrasive is the only way to ensure consistent results.

A versatile process

Although working with fine media has added restrictions, it is the fineness that makes micro blasting an ideal process for a wide range of medical manufacturing and other applications. Additional types of abrasives used in micro blasting such as crushed glass, plastic media and walnut shell further expand the options. From a light texture to removing a coating or cutting completely through a material, micro blasting can be an effective process with the right media. mdt

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