Features of ultrasonic, micro, deburring, and cleaning equipment

Powerful ultrasonic waves are generated in a liquid (water or other cleaning agent) to generate a myriad of spherical micro vacuum nuclei (these are the true cavities generated by ultrasonic waves) using our proprietary technology and know-how.

Positive and negative shock forces are generated during the creation and annihilation of these microvacuum nuclei = microgalaxies = true cavities.

The former generates shock waves outward from the center of the microvacuum nucleus group, while the latter generates shock waves in the direction of attraction toward the center of the nucleus (see [SHIBANO Theory] for details).

These [positive and negative] shock waves are generated and dissipated more than 2,000 times per second.

One example of the high-speed movement of gases is gas explosions, but what is moving at high speed during the creation and annihilation of microvacuum nuclei groups is a much denser liquid.

The liquid moves at 200 to 300 meters per second (positive explosion), then in the opposite direction, at 250 to 350 meters per second (negative explosion) (Shibano presented at the 1993 Washington Conference). This is repeated more than 2,000 times per second, and countless micro vacuum nuclei are created and annihilated in a synchronized manner (see [Ultrasonic Cleaning SHIBANO Theory] for details).

The microvacuum nuclei generated near the burrs = cavities, which in turn generate positive and negative impact forces (expressed differently: repeated pushing and pulling) on the burrs more than 2,000 times per second.

As a result, minute burrs are blown away in an instant, and burrs that have been crushed and are stuck to the body are gradually triggered and destroyed (broken) by the same repeated stresses because the impact force acting in the negative, or tensile, direction is stronger than the positive (some engineers still consider the dirt removal mechanism by the cavity as a one-directional impact wave = microjet, but this may only bite dirt). ), it is gradually triggered and destroyed (broken) by the same repeated stresses.

The rest is a precision cleaning process.

If you are interested in a more detailed removal mechanism, please refer to [SHIBANO Ultrasonic Deburring Cleaning Document].

Deburring and cleaning of computer parts

Deburring and cleaning of precision machine parts

Deburring and cleaning of automotive parts

Deburring and cleaning of telecommunication equipment parts

Removal of micro burrs and precision cleaning of other metals, plastics, ceramics, etc.

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# Ultrasonic Deburring and Cleaning Overview

Blue Star R&D, Inc.



# Ultrasonic Deburring Features

Ultrasonic microdeburring is a completely new technology and has features not found in conventional deburring.

Let's consider this in comparison with other means of deburring.

Barrel polishing is a widely used method useful for surface modification, polishing, and deburring.

However, it is not suitable for composite parts made of metal and plastic, electronic circuit parts, and parts for which surface modification and polishing are not desired.

Above all, one must be prepared to be extremely contaminated with polishing powder, barrel compound, etc.

Edge coner is machined to R.

Not suitable for precision machining deburring as a result of recent precision machining technology, such as fine stop holes, crossed holes, and deep kohners.

In addition, most of the processes are long batch processes, making line production difficult.

Wastewater treatment and, in general, powerful ultrasonic cleaning are required for finishing.

An improved version of this type of barrel is the magnetic barrel.

The level of pollution is low, and there is no need to consider even wastewater treatment.

However, it still has the basic characteristics of barrel polishing.

Basically, it is difficult to reach the inner surface of the target workpiece. Of course, it is not suitable for those with magnetic problems.

For ultrasonic deburring, the edge combiner cannot be set to "R".

As a special case, several methods that combine ultrasonic waves and abrasive grains have been put to practical use and have been proven, but they do not provide the same edge control as a barrel.

However, it is not contaminated, can be line processed in large quantities, and depending on conditions, is good at fine stop holes, cross holes (not easy), and burrs on thin M2 or so threaded holes.

Micro burrs, for example, at the entrance of a 0.125 mmΦ fiber-optic connector, are difficult to achieve by other methods.

Ultrasonic deburring is best suited for microdeburring of complex and precision parts that are difficult to deburr with a barrel, but if you are getting good results with a barrel, why not consider it as finish cleaning and finish deburring?

Shot blasting is an important and indispensable deburring and surface modification technique that uses a variety of solids, from walnut powder to glass beads and iron balls (including ice particles, carbon dioxide gas, and even room temperature melting solvents developed by SHIBANO), to impact the object to remove burrs, It is an important deburring method and surface modification technology that is indispensable in the future.

However, due to its nature, it easily leaves surface damage and is not suitable for complex shapes or composite parts.

Organic shots also pose a risk of ignition and explosion and require caution.

Furthermore, with some exceptions, the issue of blasting agents as industrial waste comes into play.

In many cases, a cleaning process is required as a post-process, which is not suitable for processing large quantities of small items in series.

In contrast, ultrasonic deburring processes large quantities of complex shapes and composite parts at once, and since water is usually sufficient, there is no risk and no waste results from the deburring process.

Of course, no cleaning is required in the post-process.

However, shot is superior for thick-walled burrs, etc.

The possible classifications are: precision micro deburring → ultrasonic, wall thickness/surface modification → shot.

# 2. Comparison with Barrel Finishing

# 1. Comparison with shot blasting

A method of removing burrs by exploding gunpowder or gas in a sealed pressure vessel using the pressure and high heat.

It is impressive as a bold idea. It is mainly used to deburr engine blocks, hydraulic equipment, etc.

Rather than removing burrs by force, they are removed by melting and fusing them with high heat.

The problem is that the high heat burns the surface, so acid cleaning is required before it can be used as a product, followed by alkaline neutralization and rinse cleaning.

It is also limited in scope. It cannot be used for electronic parts, composite parts, rubber, or plastic.

The biggest drawback is the need to manage explosives or gases, which cannot be easily implemented.

Prices are extremely high.

Ultrasonic deburring requires no post-processing, is risk-free, and can be easily handled by anyone.

Since the impact force is also surpassing thermal deburring, we believe that ultrasonic deburring will replace it, with some exceptions.

High-pressure sprays above 50㎫ are difficult to fix and involve destruction of the object.

Thus, 15㎫ to 50㎫ is the pressure of common deburring high-pressure sprays that are commercially available. Note that some high-pressure sprays are found with fan-shaped or filled-conical nozzles to provide area instead of a straight nozzle, but this is not deburring, but rather high-pressure? spray cleaning.

It is difficult to compare the more than 20,000 positive and negative shock waves per second generated by ultrasonic cavities with spraying in only one direction, but in a paint peeling test used to check deburring, the results were more powerful than the 25㎫ high-pressure spray (5 mm diameter, 50 mm away, sprayed vertically) and equivalent to 50㎫. However, in a paint peeling test used to check deburring, it was found to be more powerful than a 25㎫ high-pressure spray (5 mm diameter, sprayed vertically from a distance of 50 mm) and equivalent to a 50㎫.

Although I admit that the positive and negative shock waves of each individual cavity are much larger, I wonder if the macroscopic average value is about this much.

High-pressure sprays have greater power and greater washout.

Because the cavities are high-speed positive and negative repetitions, they diffuse microscopic dirt, but have little power to wash it away like a spray.

However, while the irradiated area for deburring with high-pressure spray is as small as 5 mmΦ per nozzle, the smallest ultrasonic irradiated area of 1200 w covers an area of 300 mm✕ 200 mm.

Also, high-pressure spray, like barrel and shot blasting, tends to bend and dent burrs due to the one-directional force, making them seemingly removed and more difficult to remove.

Burrs deep in small stopholes are pressed down rather than removed. A very significant feature of ultrasonic waves is that the negative shock wave is greater, i.e., it raises fallen objects and pulls off and removes burrs that have been crushed.

Unlike high pressure, no labor is required to fix the workpiece, and small precision parts can be processed together.

Today, it is being used in automotive valve bodies, transmission gears, and rotors of hydraulic equipment, which were thought to be possible only under high pressure, or even under high pressure.

It is being improved more and more, and we think that it has passed 50㎫ and is coming to stability.

The use of deburring is expanding from micro burrs in electronic and computer parts to deburring of machined parts.

The most important differences are that they are easy to maintain, do not require special pumps, do not take up much space, and require much less electricity.

Of course, this ultrasonic deburring technology is unique to our company and is based on the SHIBANO theory.

It is not applicable to ultrasound in general. For the record.

# 4. Comparison with thermal debarring

**3. Comparison with high-pressure spray cleaning**

Ultrasonic deburring has many unique features.

**1. No choice of material**

Metals, plastics, ceramics, and their composites Basically, most materials can be handled, although there are some difficulties.

**2. Unrestricted by shape**

Burrs occur in multiple directions, including tolerance holes on the inner surface.

**3. Not limited in number**

From one to tens of thousands of pieces can be processed at a time or in succession.

**4. No hazardous materials are generated**

Do not use hazardous materials; use water.

**5. Removes burrs while cleaning without contaminating the cleaned material.**

Precision cleaning is possible.

**6. No special technology or skill is required for use.**

It is also easy to automate and thus easy to manage.

**7. Micro burrs (micron size) can be removed more quickly and reliably.**

It is the only means that can be used for future precision machining.

**8. Low consumables**

Running costs are low because the only consumable part is the filter.

**9. Low equipment costs**

This is a problem in terms of sales strategy, as it is the only one of its kind, but in any case, the system is far less expensive than other competing methods that require precision ultrasonic cleaning after deburring.

**10. Drying can also be made into a line.**

Suitable for treatment of air from precision parts processing due to low re-deposition of stains.

**11. No need for isolated deburring, cleaning rooms, etc.**

The above advantages mean that they can be installed in a clean room or other environment, and do not require isolated deburring and cleaning rooms, as other means do, reducing administrative costs.

# Comparison with other major deburring methods

The burr is discharged between the burr and the electrode in a thick salt water and melted by the heat of the electric current to remove the burr.

This method generates hexavalent chromium when stainless steel is used, salt water treatment, heavy metal treatment, electrode control, and above all, salt shortens the life of the equipment, and equipment opportunities are dwindling rapidly. Ultrasonic deburring can replace the majority of these problems.

# 7. Comparison with electrolytic deburring

One of the most widely used methods today. Mainly manual.

Uneven quality and a source of more minute burrs, known as secondary burrs.

Many of them can be replaced by ultrasonic deburring. The cleaning that used to be necessary can also be eliminated.

# 6. Brushes, bamboo spatulas, etc.

A development of barrel finishing, it is used in combination with shot to deburr rubber.

It is used at minus 150 degrees Celsius or less. Ultrasonic cold deburring is under development.

# 5. Cold Barrel