APPLICATIONMagazine

ACTON FINISHING

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APPLICATIONMagazine

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ADDITIVE MANUFACTURING
Case Studies

Most additive manufactured parts require some surface improvement to ensure that they are in an acceptable condition for the end-user.

Processing of metal and polymer 3D printed parts, to improve the surface appearance and smoothing can be challenging. These parts tend to have a textured surface and require improvement of surface roughness

In order to improve the appearance, surface roughness and mechanical properties of additive manufactured parts, post processing remains an important factor.

Our range of fnishing technologies are available as standalone machines or can be integrated as fully automatic systems. Our aim is to ensure our customers understand the main advantages of each technology.

Here are some of the additive manufactured parts we have mass finished successfuly.

CASE STUDY 1

Cost Effective Vibratory Finishing Solution for Processing Selective Laser Sintering Parts.

About this project

ActOn Finishing developed a vibratory finishing solution to smooth 3D printed polypropylene parts, manufactured by Ricoh UK Products. These components are made via Selective Laser Sintering.

As the customer manufactures Selective Laser Sintering parts in different shapes and sizes, they were interested in purchasing a Vibratory Finishing system that can accommodate these parts and which would help them achieve a smooth surface finish to offer added value to their customers.

What we did

The polypropylene samples we were provided by Ricoh to test included rotary atomizer head, rotary atomizer hub, adhesion samples, tension rod, VW bumper components, wing mirrors and automotive exterior trim. The initial surface roughness of these parts ranged between 3.6 microns to 13 microns.

We carried out two trials using our Vibratory Finishing machines. Using a highly abrasive ceramic media and a concentrated liquid compound, that acts like a cleaner and polisher, we finished the 3d printed parts in our

Vibratory Bowl machine, for 20 hours. Visually the finished parts looked good, had no damages and the Ra was between 0.5 and 3 microns.

Proving that Vibratory Finishing is the way to process parts, manufactured via selective laser sintering, we decided to also test the finishing process in an ActOn Trough Vibratory Finishing machine. As Ricoh also manufactures larger and longer parts, the Trough finishing machine would give them the flexibility to process all types of parts, due to the shape of the process chamber. The trial proved to be a success showing an improved surface finish.

The result

Taking the rotary atomizer head as the example the Ra value started at 7.2 Microns. After the 4 hours process, in the Trough machine, this was reduced to 5.9 Microns and then to 3.681 Microns in 8 hours. There were no sign of contamination and part looked good visually.

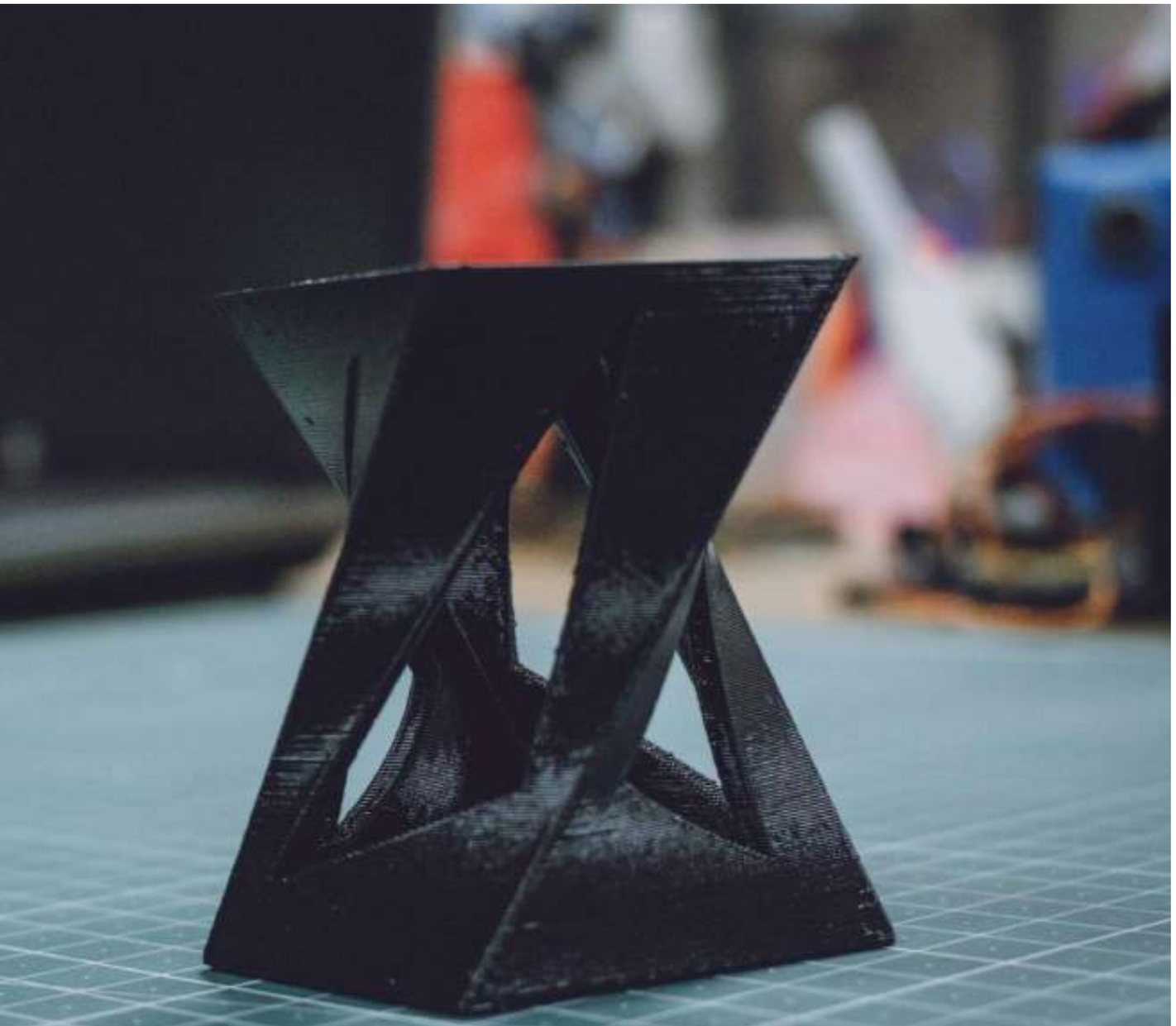
We discovered that a finishing process between 8 and 20 hours can result in damaging the thinner wall sections of the part. Therefore, we recommended Ricoh UK Products a finishing process between 4 and 8 hours in ActOn Vibratory TU9 machine using mix sizes of the abrasive ceramic media, the concentrated liquid compound for cleaning and polishing and water.

We suggested that the TU9 finishing machine should be used with a divider plate, to create a chamber for the smaller parts to be processed and a chamber for the larger and longer components. We also included a jog button on the control panel to help bring the parts to the top of the media to make it easier for operators to collect the parts.

Benefits of the vibratory finishing process

- In a 4 hour Vibratory Finishing process most of the SLS parts are smoothly finished.
- The process reduces the faceting caused by the printing process and could also be a method for reducing the orange peel.
- The mass finishing solution helps our customer to achieve an Ra value of approx. 3 Micron.
- This is visually a good result, parts being smooth to touch.
- The solution offered by ActOn is cost effective as client can use only one finishing machine to process 3D printed parts of different shapes & sizes.
- The ROI for this project was 34 week.

Other Finishing Process Results for **POLYMER 3D PRINTED PARTS**



Below results are based on the finishing processes we have developed for our clients, on various polymer additive manufactured parts.

	Average Ra before the finishing process (µm)	Average Ra after the finishing process (µm)	Average finishing process time (min.)
Vibratory Finishing	6.97	1.16	480
Vibratory Finishing	13.05	2.46	480
Vibratory Finishing	13.25	1.33	480
CDF Machine	7.23	0.88	240
CDF Machine	7.56	1.23	240

Note:
A combination of process technologies may be required for optimal results.

Ra Before: 13.25 µm

Ra After: 1.33 µm

ActOn Finishing worked closely with **The Manufacturing Technology Centre (MTC)** to develop an optimum Finishing solution which benefits the industry by reducing processing times and producing a repeatable and quality AM component.

The aim

The AM parts have been built using SLM or EBM processes, from materials like Ti6Al4V. Hence these required intensive manual finishing, to remove support structures and to smooth down rough surfaces. Our objectives included:

- Identifying a cost-effective finishing process for the external surface of the part
- Develop a finishing process for the internal surface of the part.

What we did

Trials have been carried out where it has been determined that the most efficient equipment is ActOn's CHEF machine to achieve sub 1µm RA surface finishes.

- The MTC has acquired an ActOn CPM-10 model and ActOn's consumables to undertake in-house development.
- Further trials have been conducted by both teams to determine the optimum machine parameter settings to process additive manufactured materials like Ti6Al4V.

Ruaridh Mitchinson, Research Engineer at The MTC comments:

"The CPM-10 has provided invaluable insight into finishing both EBM and SLM AM parts. This has provided the MTC with a low cost means to efficiently and effectively conduct R&D into surface finishing of additive manufactured parts."

The result

- We achieved a Ra of sub 1µm in 5 hours, 80% faster than traditional finishing.
- Achieved a Ra between 2µm to 3µm in approx. 30 minutes.
- 46% cost savings on the finishing process.
- From reducing surface roughness, to deburring and polishing these are just a few of the applications that have been achieved via the high energy finishing process.
- The project provided further information regarding surface finish parameters, component weight loss, media weight loss, effectiveness of using media with different abrasive grades and hardness.

CPM10 Machine

CASE STUDY 2

Identifying a Cost-Effective Surface Finishing Process for SLM 3D Printed Parts

Additive manufactured part before the CHEF process

Additive manufactured part after the CHEF process

CASE STUDY 3

Achieving a Bright Polished Finish on Stainless Steel 3D Printed Lizard

The aim

To smooth the surface and achieve a bright polished finish on a Stainless Steel 3D printed lizard.

What we did

We achieved this with our three-stage process, using the ActOn CDF machine, which combines grinding, smoothing and polishing. Due to the rough surface of the part, a high density ceramic media and LQ18 compound were used in the 1st stage.

The second stage was carried out using an abrasive plastic media and a finishing compound, which is a good cleaner, polisher. The aim of the second stage was to smooth the 3D printed lizard surface without affecting the dimensional integrity of the component.

Careful consideration to the media shape and size was given to ensure all areas of the component were processed.

Lastly, the 3D printed lizard was processed using a porcelain media and a finishing compound, specially formulated for polishing and brightening of ferrous and non-ferrous metals.

The result

The total process time took approx. 6 hours which was less than what the customer expected. The process delivered a superior bright polished finish while the dimensional integrity of the part was maintained

CASE STUDY 4

Improving Fatigue Strength of Additively Manufactured Ti6Al4V Through Surface Post Processing

This case study has been conducted in partnership with **The Manufacturing Technology Centre (MTC)**, Coventry. For more information on this case study please check the International Journal of Fatigue (2020).

The aim

The objective of this study was to investigate how the fatigue behaviour of additively manufactured Ti6Al4V aerospace parts, produced with both laser powder bed fusion and electron beam powder bed, with rough as-built surface could be improved using CHEF finishing.

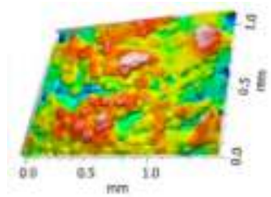
What we did

Trials have been carried out on different L-PBF and E-PBF parts to reduce the surface roughness and achieve a polished finish. The final approved process included 3 stages:

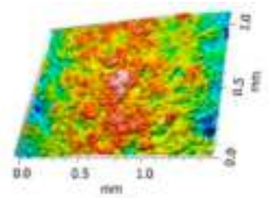
- **Cutting stage:** with a highly abrasive ceramic media & LQ18 compound;
- **Smoothing stage:** with a medium abrasive ceramic media & LQ16 compound;
- **Polishing stage:** with polishing media.

The result

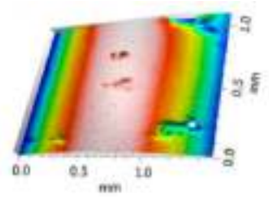
- The fatigue strength on components has greatly increased by over 100% using the CHEF machine
- It has been determined that CHEF technology is perfect for surface finishing freeform external geometries, simple internal or recessed geometries, complex external geometries



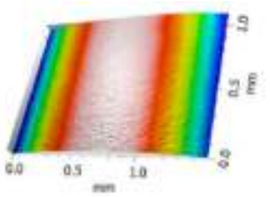
Overview of measured surface topography for E-PBF part as built.



Overview of measured surface topography for L-PBF part as built.



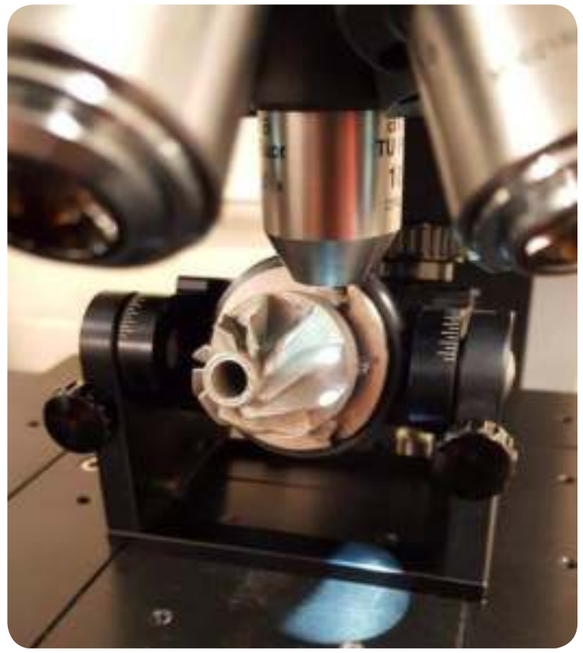
Overview of measured surface topography for E-PBF part after CHEF finishing.

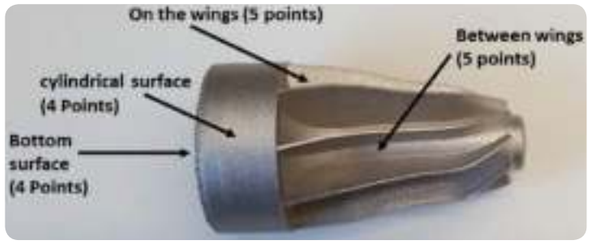


Overview of measured surface topography for L-PBF part after CHEF finishing.

CASE STUDY 5

Improve Surface Finish of Ti-6Al-4V/Al205 Additive Manufactured Impeller.





About this project

This case study has been conducted in partnership with **University of Birmingham** and **AMTECAA**. Its primary scope was to improve the surface roughness of this automotive part in different positions. This was done after 3D printing and after polishing with different methods to compare the effectiveness of the polishing method.

Measurement method

To measure the surface roughness of the samples, a focus variation microscope (Alicona G5) has been implemented. Surface roughness is reported as Sa (arithmetical mean height). The measurements were done on three, 3D printed Aluminium impeller (labelled as A1, A2 and A3) and three Titanium (labelled as T1, T2 and T3).

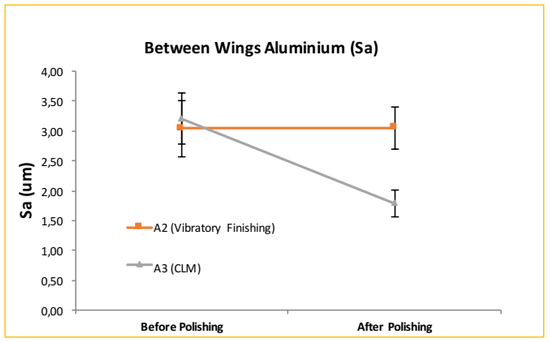
The polishing methods used included: Vibratory Finishing, CLM finishing, CHEF finishing, CDF finishing. Below you can see the positions where the measurements have been taken:

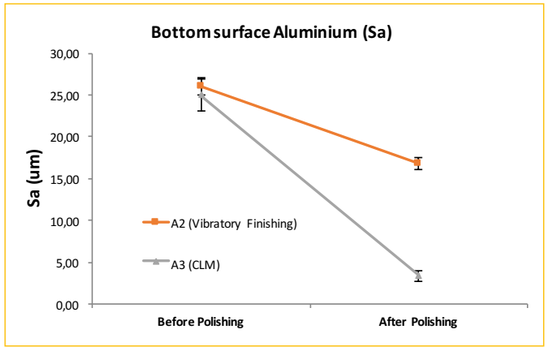
Finishing trials

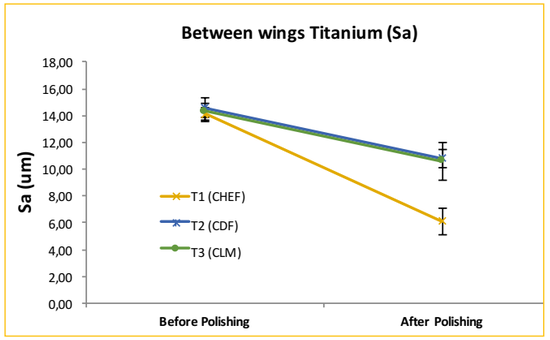
Further to the trials conducted in ActOn finishing machines it has been determined that the most efficient technology to polish and improve the surface roughness would be the CHEF technology, followed by the CL, technology & CDF finishing. While vibratory finishing has improved the surface roughness of the impellers, the results show that this method was less efficient.

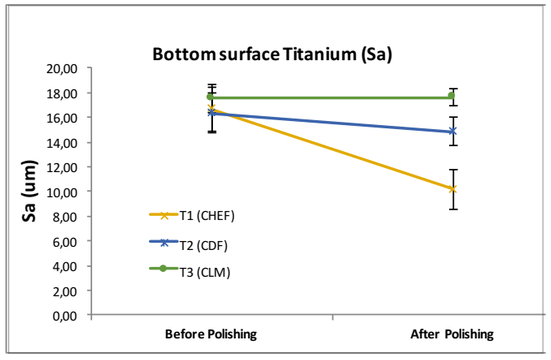
The result

The process delivered a superior bright polished finish, while the surface roughness was improved using the proposed technology. Moreover, the dimensional integrity of the part was maintained.









AEROSPACE
Case Studies

We understand the importance of surface finishing for aerospace engines, and have worked closely with major manufacturers in the aerospace industry to adapt and develop finishing solutions that meet their stringent requirements.

It has been proven that the solutions we've developed have benefited the industry by reducing processing times & producing a repeatable and quality product.

Manufacturing companies usually implement mass finishing techniques in their processes for the economic advantages, and the consistent results achieved. Manual finishing processes are known to be labour intensive, with the disadvantages of rework and high rejection rates, and inconsistent results. Having identified the issues, we offer a wide range of unique solutions that improve current processes, achieving the repeatability and quality desired by aerospace manufacturers.

In the next pages you can check some of the aerospace parts we redefined, as a leading surface finishing partner to first tier suppliers, MRO and OEM engine manufacturers

CASE STUDY 1

Aerofoils. Remove Defects. Form Root Feature.

The aim

To Identify and remove surface defects on aerofoils and to form a root feature

What we did

Traditional methods of removing surface defects revolve around all over manual polishing, which has a low right-first-time, high tooling cost and inconsistent output.

Our high energy process redefines the processing of aerofoils. The unique design of the machine delivers the highest polishing efficiency in our two-stage process, which combines the removal of imperfections on the surface followed by refinement to improve the Ra values.

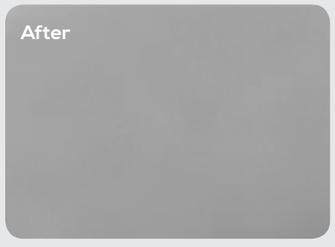
The PLC programme allows individual recipes to be programmed for each part number. In addition, the automatic media recirculation system ensures a consistent output is achieved with minimal operator intervention. The machine and process delivers consistent results, with a superior surface finish.

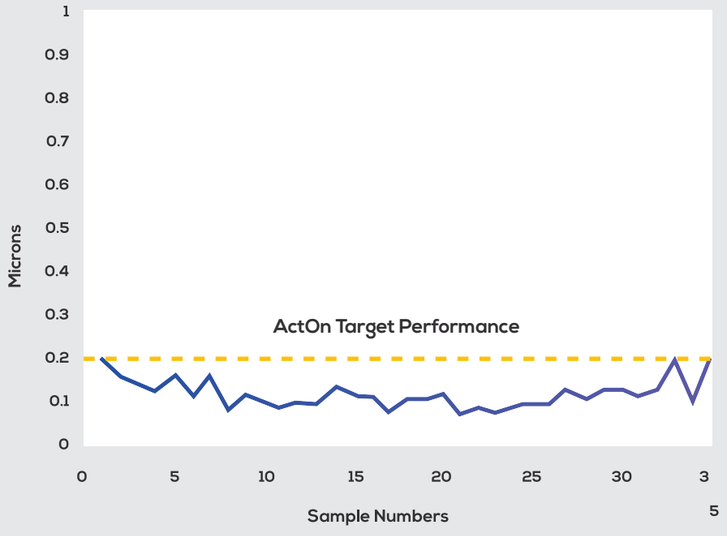
In most cases, all defects are removed from the high energy finishing process These defects include pitting, die breakdown, rippling, crimping, preferential etch and many more. On the occasions where the forging has heavier localised defects, we have a precision polishing facility that works on removing such defects. The aerofoils are inspected to the customer approved visual standard, with all documentation controlled for traceability purposes.

Post clipping, the root of the aerofoils are formed and the edge is deburred. This is an important aspect of the process to remove the stress concentrations. The surface is then blended before a final visual inspection. An edge thickness check is part of the inspection process. The aerofoil is then delivered with a certificate of conformity to the approved standard.

The result

The end result is an aerofoil with an average right-first-time of 92.7%, delivered to a high standard in a considerably reduced time. The dimensional integrity of the part was maintained, whilst all defects on the surface were completely removed.





CASE STUDY 2

Achieve a High Polished Finish on Just One Side of the 3D Printed Part.

The aim

This project required finishing an additive manufactured Inconel wheel. The part end finish implied a high polished surface on one side of the wheel whilst leaving the other side untouched.

What we did

The entire part is built via additive manufacturing and it includes a 3D mesh. Hence whilst the front side appears smooth the back of the component would comprise of a very fine mesh with numerous gaps. Therefore, the mesh side of the part must be completely covered to an air tight tolerance during any mass finishing process. This ensures that no lodgement of media can contaminate the mesh side and no impingement of the structural integrity of the wheel.

We examined the component and determined that a masking solution should be developed to cover the mesh side. We designed the masking solution to be air tight in order to not move while the part was processed.

The finishing process included 3 stages:

- We carried out the first stage by deburring the wheel in the CHE40 machine with an abrasive ceramic media and an acidic compound. This compound is great for removing scale, brightening and polishing ferrous metals.
- To smooth the surface we used a medium abrasive ceramic media and the same acidic compound. For a more effective process we finished the parts in the same finishing machine.
- The last stage included polishing the surface in the CHE40 machine using only pre-treated media. In the high energy machine it has been proved that the pre-treated media produces a bright mirror finish in a reduced time.

The result

This process achieved a 90% loss in roughness average, as requested by the customer. The masking solution was successful and completely protected the rear side of the component. Furthermore the polished finish required on one of the surface was achieved in only 3 hours without affecting the other side of the wheel.

Before **After**

CASE STUDY 3

Various Rolls Royce Parts. Improve the Components' Finishing Quality and Increase Productivity.

The aim

During the shelling process, there is a buildup of ceramic slurry on the various equipment used such as matting, rubber caps, handles, plates and cruciforms ActOn Finishing were contacted by Rolls Royce Bristol to look at improving the cleaning process to ensure a faster process time and more consistent results.

What we did

After carrying out live trials at our facility, it was proven that the Vibratory Finishing machine was the right solution to clean parts quickly and consistently. Due to space restrictions, a Vibratory Trough was chosen which had the added flexibility of processing parts of various sizes.

The system has several advantages such as:

- Easy to maintain;
- Compact footprint;
- Quiet in operation;
- Small and large parts can be processed.

The result

The new solution by ActOn gave Rolls Royce the following benefits:

- Improved cleanliness.
- Process time reduction from 60 min. to 10 min.
- 3 times more volume that can be processed at once.
- Reduced water consumption.

Henry Illsley (Shell Process Engineer, Rolls Royce Bristol) states:

"ActOn were quick to develop a solution for the shell cleaning system. The machine has improved our throughput significantly and we are pleased with the quality of machine that they have manufactured and installed. We look forward to working with ActOn on future collaborative projects."

Before

After

CASE STUDY 4

Uniform Finish & Ra Under 0.8µn Using CHEF Technology.

The aim

To achieve a Ra value of 0.8 µm (from 1.62 µm) and a uniform finish. Customer asked for a a cost effective finish to process 1000 blades / batch.

What we did

We achieved the final finish in the CHEF machine, as it allowed us to process all 1000 blades in one batch, without damaging the components.

To achieve the surface finish we processed the parts in a mix of abrasive plastic media and a concentrated cleaner and polisher for non-ferrous metals. Both finishing consumables are well accepted by the aerospace industry.

The result

We achieved an Ra value of 0.67µn and a smooth finish in just 15 minutes; and the dimensional integrity of the part was maintained.

Before **After**

CASE STUDY 5

Clean the Surface of Aluminium Side Stays and Achieve an Ra under 6.2µn

The aim

To achieve a Ra value under 6.2 µm and a clean finish on Aluminium Side Stays.

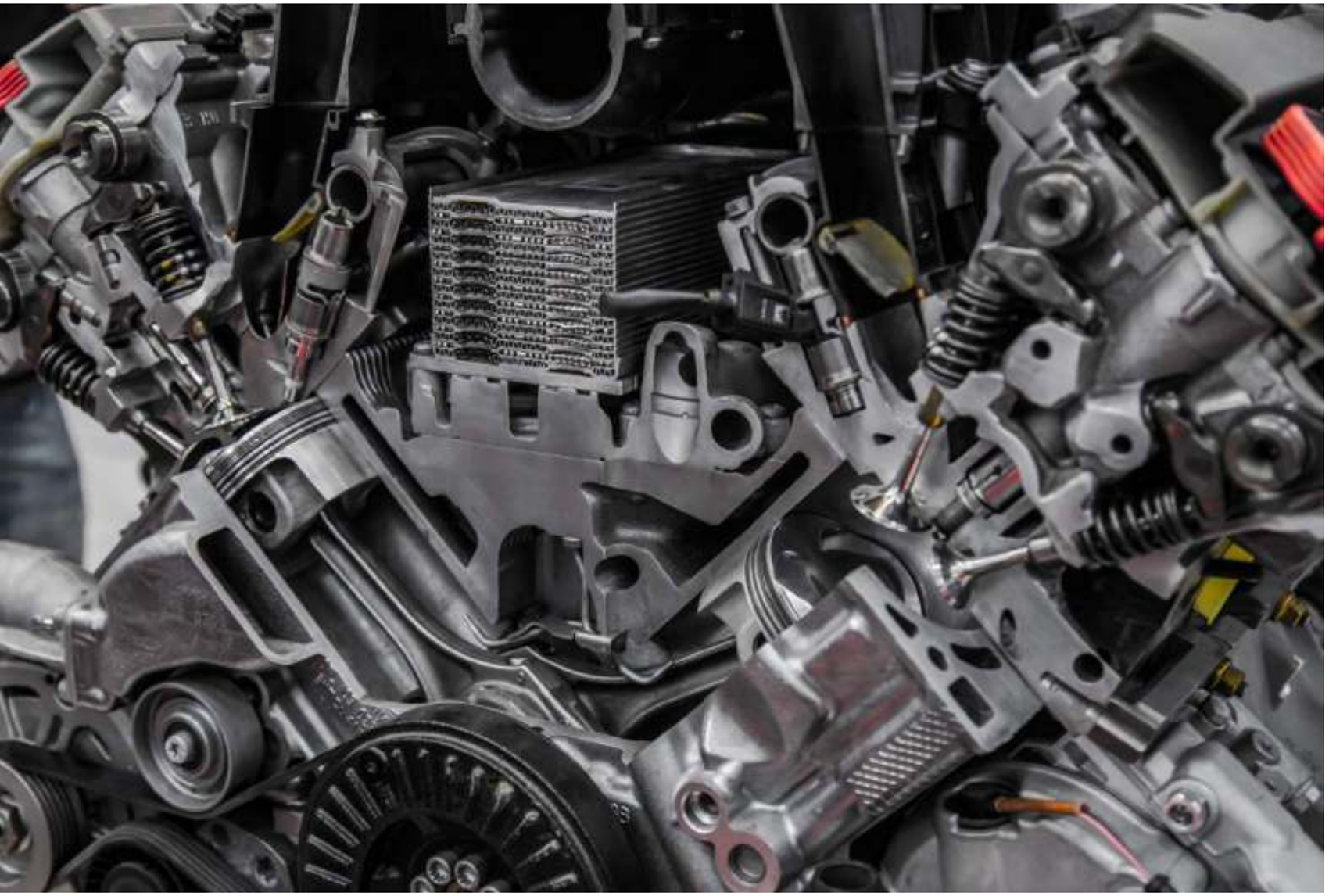
What we did

We finished the parts in the ActOn Vibratory Trough machine. This machine is perfect for larger and long parts. Components were finished using an abrasive ceramic media and an acidic compound for removal of light heat treatment, scale, brightening and polishing suitable for ferrous and non-ferrous metals.

After **Before**

The result

We achieved an Ra value between 2.09 µn and 1.24 µn and a clean finish in just 40 minutes.



AUTOMOTIVE
Case Studies

The automotive industry is rapidly evolving towards more efficient vehicles where automotive components have to be durable and fuel economic. It has been proven that the solutions we've developed have benefited the industry by reducing processing times and producing a repeatable and quality product. These finishing processes are ideal for high volume production, can be easily automated and ensure that the components' geometry is integral.

Here are some key benefits you will enjoy when switching to mass finishing:

- Durable components
- Increase part resistance to pitting and scuffing
- Reduce fuel consumption
- More resistant components to bending
- Less operating temps
- Less friction
- Lower requirement of lubrication which also reduces the cost

CASE STUDY 1

Alloy Wheel. Cleaning and Bright Polishing.

The aim

Develop an efficient process to clean and polish alloy wheels to a bright finish.

What we did

At ActOn Finishing we have developed a high quality, repeatable finishing solution to polish alloy wheels in just a few hours, using the AWP188 wheel polishing machine. To achieve the highly polished finish the alloy wheels go through 3 processing steps:

Step 1: Cut down

Wheels go through the grinding process using the PWP media and LQ16 which is a concentrated cleaner and polishing compound. Depending on the initial condition of the surface the process time can take between 2 to 6 hours.

Step 2: Smoothing

After the surface has been cut down it needs to be smoothened and prepared for the polishing stage. This is achieved using PKW media and LQ16 compound. The time needed to carry out this process can vary from 2 to 3 hours.

Step 3: Polishing

The final stage includes polishing the wheels with PHD polishing media and LQ9 compound. The process time can take between 1 to 3 hours. This media is great for achieving a bright highly polished finish while LQ9 has been formulated for polishing both ferrous and non-ferrous metals.

The Result

The process delivered a clean and bright polished alloy wheel in a considerably reduced time, and the dimensional integrity of the part was maintained.

CASE STUDY 2

Crankshaft Mirror Finishing

The aim

To prepare the surface for heat treatment and to achieve a Ra value of 0.4 µm and a mirror finish.

What we did

We have achieved this in our three-stage process, using ActOn Vibratory Trough finishing machine, which consists of deburring, smoothing and polishing.

The first stage prepares the component's surface for heat treatment. Once the crankshaft undergoes nitriding, the component is processed using ActOn's polishing media and special Turbocut compound to achieve the surface finish required.

Divider plates are used in the trough machine which enables processing more than one crankshaft at a time. This reduces the processing time and the risk of impingement. The machine and process delivers consistent results, with a superior surface finish.

The Result

The process delivered a superior surface finish in a considerably reduced time, and the dimensional integrity of the part was maintained. A complete end-to-end solution.

CASE STUDY 3

Cleaning and Deagreasing Valve Seat Guide

The aim

Achieving a clean and degreased surface in a 1 lap process.

What we did

We have achieved this finish in a single stage process, which takes 2 minutes, using our Vibratory Bowl machine. Our team developed a unique process, using a single type of media and compound. The media used was carefully chosen to avoid lodgement, while the compound used has been specially formulated for cleaning, degreasing and giving prolonged corrosion protection to ferrous parts.

The system is automated to enable processing high volumes of parts, to reduce manual handling and ensure consistent results.

The Result

Through the single-step process, the overall process time required is accomplished, the parts are cleaned and degreased and the results achieved are consistent.

CASE STUDY 4

ActOn CHEF Technology Processes a Week's Worth of Production in 1.5 Days

About this project

ActOn team had the opportunity to work with a leading automotive component manufacturer, to develop a mass finishing technology to radius and clean automotive sintered parts.

Our customer is an innovative global supplier of quality products, trusted brands and creative solutions to manufacturers of automotive, light commercial, heavy-duty and off-highway vehicles. They are committed to delivering superior quality through innovation and engineering excellence, using cutting-edge processes.

The aim of the project was to clean the Sintered Pivot Blocks and radius the edges, based on the customers' manufacturing volumes, which consists of 20,000 parts per week.

What we did

ActOn initially carried out trials in the Vibratory Finishing machine as this finishing technology is capable of processing large batch quantities. After trials with different grades of ceramic media, it became clear that Vibratory Finishing could not achieve the required finish.

Trials were then carried out in the ActOn Centrifugal Disc Machine, capable of processing parts 5-10 times faster than Vibratory Finishing however this process struggled to reach the required standard after one hour of processing. At this processing time, it would be difficult to reach the required output of parts.

This is when ActOn looked at the Centrifugal High Energy machine. The finish was achieved in just 20 minutes using a medium abrasive ceramic media and a specially formulated compound for sintered parts due to its corrosion inhibition & low foaming qualities.

Finishing Technology

As a result of the successful trial the customer decided to purchase the CHE-40 finishing technology. The system is HMI/ PLC controlled and it includes 100 finishing recipes which makes the machine easy for the operator to use.

CHE40 machines are equipped with 3 hexagonal shaped barrels. Each of these barrels are loaded manually with parts, media and a water/compound mix as per the recipes set up in the system.

High Energy finishing can be 15-20 times faster and produces superior finishes. It is one of the most efficient batch finishing methods. This process time advantage meant that the customer was able to process a week's worth of production in just 1.5days.

The finished parts are discharged from the machine on a Vibratory Screen Separator to separate the media from parts. Due to the similarity in size between the media and parts, we needed to find a solution to separate the parts from the media after the process. The pivot blocks have a magnetic field so it was therefore decided that the only way to guarantee 100% separation of the parts and the media was by using a magnetic separator. The parts are then de-magnetised prior to maize drying in our VBD6 vibratory drier.

The result

The process delivered a clean surface and radiused edges as per customer requirement, in a considerably reduced time. Furthermore, the process has enabled our customer to achieve the weekly production volumes whilst maintaining superior product quality.

CASE STUDY 5

Smooth Finish on Crank Case.

The aim

Achieve a smooth and even finish on aluminium crank case.

What we did

We achieved the final finish in a single stage process, which takes 20 minutes using our Vibratory Trough.

Divider plates are used in the trough machine which enables processing more than one crank case at a time. This reduces the processing time and the risk of impingement.

As certain areas of the crank case could easily become lodged with media, the size of media was an important factor in this process. Moreover, we chose a low-grade plastic media to prevent any damage to the part.

The liquid finishing compound used is a concentrated cleaner and polisher for non-ferrous metals.

The result

We achieved an Ra value of 0.67µn and a smooth finish in just 15 minutes; and the dimensional integrity of the part was maintained.

Before

After

CASE STUDY 6

Deburr & Smooth Finish Engine Covers

The aim

Deburr, remove defects and achieve a smooth finish on casted engine covers.

What we did

We used our vibratory finishing bowl to deliver consistent results. The covers were first deburred using ActOn plastic media & a light descaling compound. Then we polished the engine covers with ActOn polishing media and polishing compound

The result

The final result was achieved in 1 hour and 45 minutes.

Before

After

CASE STUDY 8

Remove Machining Lines on Piston

The aim

Remove machining marks, achieve highly polish finish on the piston and develop an efficient process for 50 parts/ batch.

What we did

In the first stage we removed the machining lines and deburred the parts in our CHEF machine, with a mix of abrasive plastic media, a finishing compound we especially designed for the automotive industry and water.

In the second stage we smoothed the surface & achieved a bright finish in a vibratory finishing bowl, using the same compound, a polishing ceramic media and water.

The result

We achieved the polished finish in 2 hours and 30 minutes; and the dimensional integrity of the part was maintained.

CASE STUDY 9

Axle Holder. Eliminate Manual Finishing & Produce a Repeatable and Quality Finish

About this project

ActOn Finishing was approached by one of its customers to develop a mass finishing process for an axle holder. The customer manufactures forge automotive parts for the motorcycle industry. They were manual polishing the components and were looking to implement vibratory finishing in their process. However, at the time they had no experience with mass finishing techniques and they needed some guidance.

The aim

- To achieve a descaled, deburred and bright finish
- The customer has very high manufacturing volumes and there is a required throughput to be achieved. Hence we had to determine the most efficient mass finishing process for the part.

What we did

We started by working out the weekly volumes and we determined that the mass finishing process should be no longer than 15 minutes. As a normal vibratory bowl may not achieve the required finish within the time frame, we decided the most appropriate finishing technology to use is the CHEF machine. Furthermore we have identified that by using divider plates in the High Energy finishing machine barrels, we can process 12 parts per load.

Our team also developed a unique finishing process, using a single type of media and compound. As the axle holder is manufactured out of Aluminium we used a medium abrasive ceramic media for descaling and deburring. We carefully chose the media size and shape to avoid any lodgment while managing to finish even hard to reach areas of the part. We used a liquid compound that acts as a oncentrated cleaner and a good polisher.

The result

The process resulted in complete scale removal and a deburred and bright finish all in a single step process, thus achieving the throughput. Here are just a few benefits of ActOn's finishing process:

- We achieved the required finish in a reduced processing time.
- We avoided any part impingement by using the divider plates.
- It produces a repeatable and quality finished product.
- Simplified the finishing process by developing a single step finishing solution and using one type of media and compound.
- Customized the finishing process as per customer's needs.

Before After

FORGINGS AND CASTINGS

Case Studies

Forging and casting are manufacturing processes used across various industries to transform metal materials into a desired geometry. Generally, forgings and castings tend to have a rough surface finish and a dull appearance. Manual finishing is time consuming and does not deliver consistent results.

ActOn engineers recommend using vibratory finishing or high energy finishing machines to achieve a smooth surface and a polished finish. Over the years, we have developed and optimised processes on various forgings and castings with different finishing specifications, such as the removal of surface defects and flash lines or achieving a surface finish of Ra 0.03 µm.

The process benefits of ActOn machinery and consumables include:

- Significant reduction in roughness
- Shorter processing time than traditional methods
- Increased part cleanliness
- Removal of surface defects and flash lines
- Corrosion protection
- Non-part specific
- No major tooling required
- No requirement of fixturing
- Consistent and repeatable results

CASE STUDY 1

Remove Graphite Scale & Polish Brass Stampings.

The aim

To remove graphite scale, polish and dry brass stampings.

What we did

We have descaled and polished brass stamping in a vibratory bowl machine and vibratory dryer.

A porcelain media and an acidic compound helped to remove the scale and brightening the surface.

To ensure the stamping is free of stains, this was dried using ActOn agro-media.

The result

The vibratory finishing process delivered the required finish in a considerably reduced time, and the dimensional integrity of the part was maintained.

Before

After

CASE STUDY 2

Remove Linishing Lines on Silver Knives.

The aim

Remove linishig lines and achieve a bright polished finish on this silver knife blade.

What we did

The first stage is carried out to remove the linish lines in the bowl finishing machine using polishing media and ActOn's Chemcut compound. This compound is recommended for removal of grinding and linishing marks, giving a rapid metal cut-down and levelling, producing a super smooth surface ready for polishing.

Once the knife blade surface has been prepared, this is polished in the HD3000 dryer along with pre-treated agro media.

The result

We achieved the polished finish in approx. 4 hours; and the dimensional integrity of the part was maintained.

CASE STUDY 3

Mirror Surface Finish on Forged Femur Implants.

The aim

Achieve a mirror surface finish, free of defects, on forged femur implants.

What we did

- We followed a three-stage process, using the ActOn CHEF machine. The implants were first processed using a highly abrasive ceramic media and Actopol compound – a fine, long lasting, clean cutting abrasive designed for deburring and achieving a surface finish improvement. Actopol prevents corrosion on ferrous parts and produces a clean smooth finish on all metal parts.
- In the second stage, we achieved a smooth surface finish with the help of our medium abrasive plastic media and a liquid compound, with good cleaning and polishing properties.
- In the third stage, the implants were given a mirror polish by processing the part in pre-treated 'Maizorb' media. The pretreated maize imparts high lustre on components when used in the CHEF machine.

The result

The process delivered a superior surface finish in a considerably reduced time with a complete end-to-end solution and the dimensional integrity of the part maintained.

CASE STUDY 4

Develop an Efficient Process to Surface Finish 700 Steel Collets / Batch.

The aim

- Achieve an Ra of 0.02 µn, from a starting condition of Ra 0.86 µn
- Polish the steel collets.
- Develop an efficient process to finish 700 parts / batch.

What we did

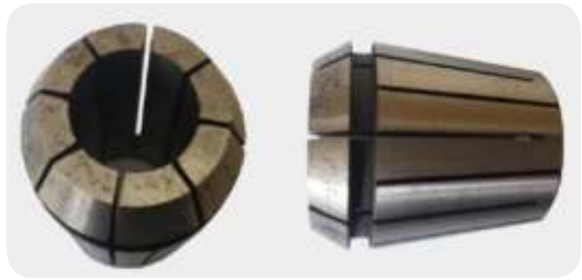
In the first stage we processed the collets in the ActOn CHEF machine, with a medium abrasive ceramic media and a concentrated liquid finishing compound designed for cleaning and polishing applications.

Once the parts' surface was smooth, we polished the collets in our vibratory bowl finishing machine, using a ceramic polishing media and the same liquid compound.

For both stages the shape and size of media was carrefuly chosen - hence any lodgement of media has been avoided and the part finish was consistent.

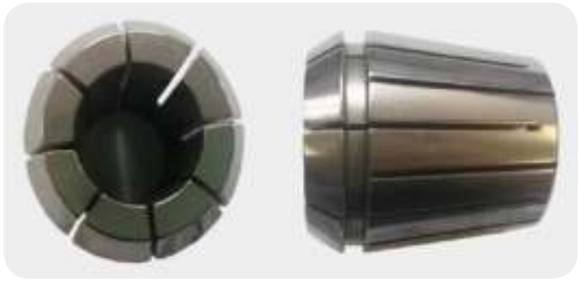
The result

We achieved the polished finish in 2 hours and 30 minutes; and the dimensional integrity of the part was maintained.



Before

After



CASE STUDY 5

Mirror Finishing INOX 316L Part

The aim

The objective of this project was to achieve a mirror finish and improve the initial surface finish.

What we did

One of the fastest ways to achieve a mirror finish in a 1 stage process, is by processing the parts in the DLyte finishing machine,

Unlike traditional polishing, DLyte® Technology differentiates itself by its ability to preserve the initial shapes, even the cutting edges, and penetrate into all dead zones. It creates a homogeneous polishing across the surface, without grinding patterns and has the ability to process complex geometries without leaving micro-scratches on the surface. DLyte® Technology respects the tolerances and delivers brilliant mirror-like finishes, with one step, and with controlled costs.

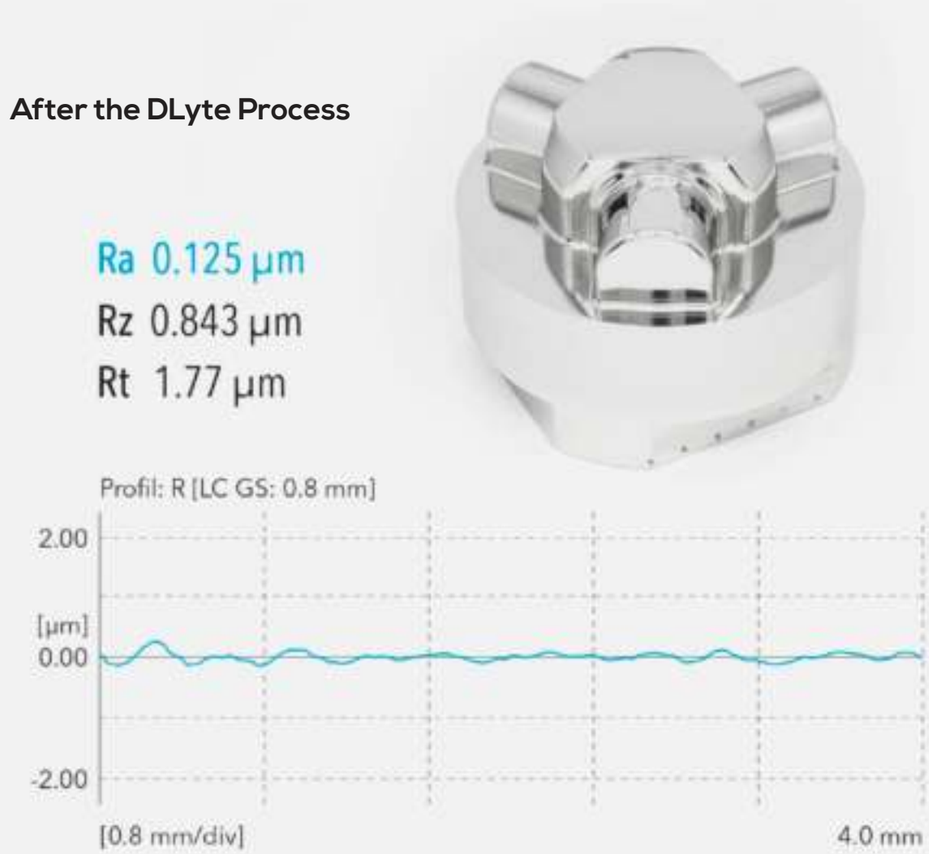
The work-pieces are clamped in specially designed holding systems in the machines. The holder of DLyte® is dragged with a combination of plantary movement, vertical back-and-forth motion & rotation on its vertical axis inside the drum containing the Dry electrolyte media. The machine includes a highperformance cathode inside the perimeter of the drum allowing uniform electrical fields to achieve homogeneous results across the surface. The automatic media conductivity adjustment system consists of a conductivity tester and a high precision pump which adjusts the media conductivity automatically.

The result

Parts finish is highly polished and the Ra is reduced from 0.692 micrometers to 0.125 micrometers.

Before the DLyte Process

After the DLyte Process



FASHION
Case Studies

We understand the importance of high quality polished jewellery in the fashion industry, and we work closely with our customers to adapt and develop finishing solutions that meet their stringent requirements.

Finishing applications we have developed for the Fashion industry:

Cleaning and Deburring: To achieve a smooth surface free from burrs the jewellery is finished using ActOn's finishing machines and a mix of plastic media, compound and water. Plastic media is highly recommended to process parts manufactured out of softer materials. The shape and size of the media will be chosen depending on the part geometry, hence avoiding any media lodgment and achieving a consistent finish.

Burnishing: This finish can be achieved in ActOn's finishing machines using Stainless Steel media and a mix of specially formulated compound and water. Through the burnishing process, the oxidation and the mass residuals deposits are removed from the parts without any impingements, which is most important on components manufactured out of gold, silver and other valuable materials. The end finish will be a consistent, refined bright polished surface.

Drying and Polishing: Using ActOn's drier machine, along with the agro media to finish the component will result in a highly polished finish. The media is an excellent moisture absorbent, which also produces a stain free polish effect, without damaging the part geometry and the set stones such as diamonds, pearls, etc. The high mirror effect can be obtained using ActOn's pre-treated agro media and the High Energy Finishing machine. However, it is not recommended to process jewellery with set stones using this finishing process.

CASE STUDY 1

Stainless Steel Jewellery. Mirror Polished Finish.

The aim

To develop a cost-effective process to achieve a mirror polish finish on stainless steel jewellery. The finishing process also implied barrelling 300 pieces per batch.

What we did

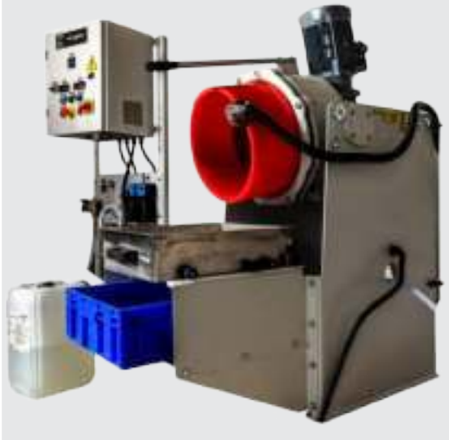
We achieved the final finish in a 2-stage process:

To achieve a smooth surface free from burrs we finished the jewellery using our DTB series (perfect for heavy duty applications such as burnishing) and a mix of a medium abrasive plastic media, a polishing compound and water.

For the mirror polished effect the pendants were in high density polishing media, using LQ9 compound, a specially formulated brightening and polishing compound. This compound is one of our best-selling products for polishing processes and is used by jewellers, goldsmiths and midsized manufacturers in the fashion industry.

The result

Our finishing process enabled our customer to process 300 parts in approx. 3 hours. This has improved considerably the time our client was spending on polishing the pendants. The process delivered a superior mirror polished finish while the dimensional integrity of the parts was maintained. Moreover, this finishing process can be replicated on other pieces of jewellery made by the client.



CASE STUDY 2

Pewter Jewellery Box. Bright Polished Finish.

The aim

To deburr and obtain a bright polished finish.

What we did

The first stage was carried out to remove the burrs resulting from the casting process. This process was carried out in ActOn's vibratory bowl finishing machine.

For the polished finish, components have been processed in the vibratory bowl finishing machine using ActOn's polishing media and compound. The polishing media is great for burnishing without damaging the geometry of the parts, while the compound has been specially formulated for polishing and brightening the surface. P6 powder was further added to enhance the brightness.

To avoid staining on the component's surface, and to ensure the bright polish finish is maintained for a longer period, the parts were dried using ActOn's agro-media. This product has a good moisture absorption rate and it ensures parts are clean, dried and polished.

The result

The process delivered a superior surface finish in a considerably reduced time and the dimensional integrity of the components was maintained. All burrs were removed and a bright, polished finish was achieved on all parts.

CASE STUDY 3

Stainless Steel Beads. Mirror Finish.

The aim

To mirror finish stainless steel beads.

What we did

We achieved the final finish in a 3-stage process:

Step 1: parts are deburred in the CDF machine with a mix of abrasive ceramic media and a concentrated cleaner and polisher compound.

Step 2: to achieve a smooth finish and prepare the beads for the mirror polishing stage, parts are finished in the same machine with a medium abrasive plastic media and the same compound.

Step 3: finally the mirror polished finish was achieved in the CPM10 machine by using only pretreated Maizorb.

The result

The process delivered a superior mirror polished finish while the dimensional integrity of the parts was maintained.

CASE STUDY 4

Remove Sharp Edges & Polish SS Clips.

The aim

Develop a finishing process to deburr and polish stainless steel clips in just 1 hour.

What we did

We processed the parts in ActOn Vibratory Bowl Finishing Machine, using a polishing ceramic media and a polishing compound designed for the fashion industry. To avoid any stains at the end of the wet process, we dried the parts in ActOn vibratory dryer, using Maizorb.

The result

The sharp edges were removed from the clips and parts were polished in 60 minutes.

CASE STUDY 5

Mirror Polish on a Delicate 3D Printed Ornament.

The aim

Smooth the surface and mirror polish a 3D printed decorative part. While the initial surface roughness was 15µm, the actual main issues faced were:

- the intricate geometry of the part which made it difficult to finish the part
- the part fragility as it was easily breakable if the 3d printed part was subject to excessive force.

What we did

We achieved the final finish in a 3-stage process:

In the first stage the part is processed in the DT finishing machine using an abrasive ceramic media and a light descaling and polishing compound.

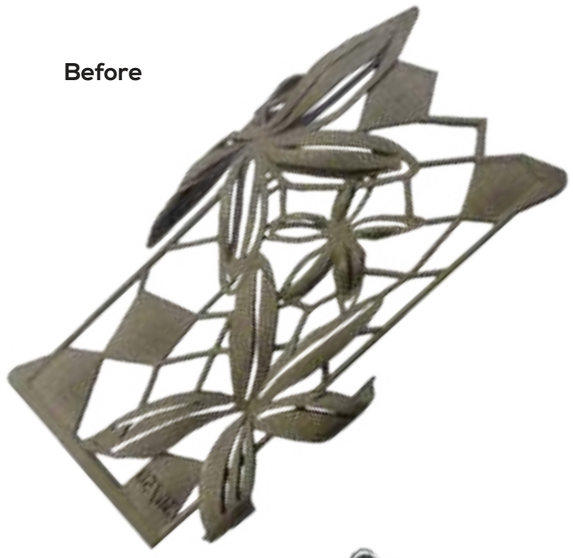
In the second stage, we prepared the surface for mirror polishing in the DT finishing machine using plastic media and a polishing compound.

Finally, we mirror finished the 3d printed part in the CPM machine using a polishing media and compound.

The result

The process delivered a smooth and mirror polished surface, reducing the part's Ra from 15µm to 0.18µm in a considerably reduced time, whilst maintaining the dimensional integrity of the part.

Before



After

CASE STUDY 6

Clean and Achieve a Bright Finish on Brass Clock Parts.

The aim

Here's an example where our client wanted to eliminate the ultrasonic stage and find a more efficient way to clean and achieve a bright finish on antique clock ornaments.

What we did

First the part is cleaned in our vibratory finising trough using a medium abarsive plastic media and a concentrated cleaner and polisher liquid compound. We used a plastic media as it is highly recommended to process parts manufactured out of softer materials.

Then we polished the clock parts in the same finishing machine, using a ceramic polishing media and a liquid compound suitable for brightening and polishing ferrous and non-ferrous metals.

Finally parts are dried in our vibratory finishing dryer, using maizorb. This stage ensures parts are shiny and no stains appear after the wet finishing process.

The result

The process delivered a bright finish in a considerably reduced time and the dimensional integrity of the components was maintained.

Before

After

HOSPITALITY
Case Studies

We understand the importance of high quality, cleaned and polished cutlery and tableware in the hospitality industry, and we work closely with our customers to adapt and develop finishing solutions that meet their stringent requirements.

By using ActOn's systems in the hospitality industry, we can guarantee that, not only will the parts be finished to a high standard, you'll also save time and money.Here's and examples on how much you can save per year using ActOn solutions:

While one employee can usually polish between 500 and 600 pieces of cutlery per hour, our HD3000 finishing machine can process 3000 to 3500 pieces of cutlery in 1 hour. Based on our calculations you can save approx. £6205/ year.

Our machine will not only save you the time spent on polishing the cutlery and tableware by hand, but also the money spent on labour and material required to polish.

CASE STUDY 1

Silver Cutlery. New Burnishing Techniques

About this project

This independent case study has been conducted by ActOn Finishing in partnership with Arthur Price and Cutlery and Allied Trades Research Association (CATRA), to determine the amount of silver plating removed from silver cutlery through the burnishing process.

Samples tested

Silver plated cutlery was used to measure the silver-plating thickness before & after the vibratory finishing process. Samples provided included:

- 1 new & unused teaspoon
- 1 new & unused tablespoon
- 1 new & unused dessert fork
- 1 new & unused fish knife
- 1 new & unused table knife
- 1 tarnished dessert knife

Measurement procedure

The plating thickness was measured using X Ray Fluorescence(XRF) techniques, at convenient flat locations, where accurate measurements could be taken non-destructively. The locations of measurements are indicated in *Picture 1 and consisted of:

Index	Cutlery Type	Location
A	Teaspoon	Bowl lower surface; surface contact point
B	Teaspoon	Handle lower surface; surface contact point
C	Tablespoon	Bowl lower surface; surface contact point
D	Tablespoon	Handle upper surface; near end
E	Dessert fork	Centre of tine; lower surface
F	Dessert fork	Handle lower surface; surface contact point
G	Fish knife	Centre of blade; lower surface
H	Table knife	Centre of handle; upper surface
I	Dessert knife	Centre of handle; upper surface

Details of test

Further to measuring the plating thickness, the cutlery was burnished for 20 hours at ActOn Finishing, using the Trough Finishing System and a mix of ActOn polishing media and liquid compound. ActOn troughs are available in many different sizes and an infinite choice of length and width combinations, making them one of ActOn's most versatile ranges.

The mix of polishing media and compound is ideal for removing oxidation and mass residual deposits and achieving a bright polished finish.

The result

- More silver plating was removed on the heavily tarnished dessert knife than on other items, due to the heavy tarnish which can be several microns thick and is more friable than the silver plating.
- Through vibratory finishing, 2.9 microns of silver plating have been removed on average from all the new and unused cutlery, in 20 hours.
- As a normal vibratory burnishing process takes 20 minutes, this test reproduced, in 20 hours, 60 normal procedures or 5 years at 1 cleaning finishing process per month.
- In 20 minutes an average of 0.05 microns of silver are removed through this burnishing process.
- After 200 cleaning procedures (16.7 years) 10 microns of silver plating would be removed.
- After 400 cleaning procedure (33.3 years) 20 microns of silver plating would be removed.
- The corner edges would probably suffer more removal of plating in practice.
- Also it is possible that heavily tarnished cutlery to suffer a faster removal rate of plating using vibratory burnishing process.
- ActOn's burnishing process is highly recommended as it causes minimal wear to the cutlery silver coating whilst keeping it bright for long periods.

Location of Measurement	Silver Plating Thickness (µm)		Plating removed (µm)
	Before Burnishing	After Burnishing	
A - Teaspoon	20.0	16.9	3.1
B - Teaspoon	23.0	21.2	1.8
C - Tablespoon	25.0	19.9	5.1
D - Tablespoon	32.3	26.5	5.8
E - Dessert fork	24.5	23.9	0.6
F - Dessert fork	21.5	20.5	1.0
G - Fish knife	24.7	22.0	2.7
H - Table knife	31.2	28.0	3.2
I - Dessert knife	36.4	27.5	8.9

CASE STUDY 2

Polish Tarnished Tableware.

The aim

Polish tarnished tableware.

What we did

The polished finish was achieved in a 1 stage process.

The tarnished parts are finished in ActOn TU4 Stainless Steel Trough machine, with a mix o porcelain burnishing media, LQ9 and water.

The result

We achieved the polished finish in 20 minutes; and the dimensional integrity of the part was maintained.

CASE STUDY 3

Polishing Cutlery System.

The aim

To design a system for the polishing and drying of cutlery.

What we did

The system we built is automated, ensuring minimum operator intervention and guaranteeing consistent results.

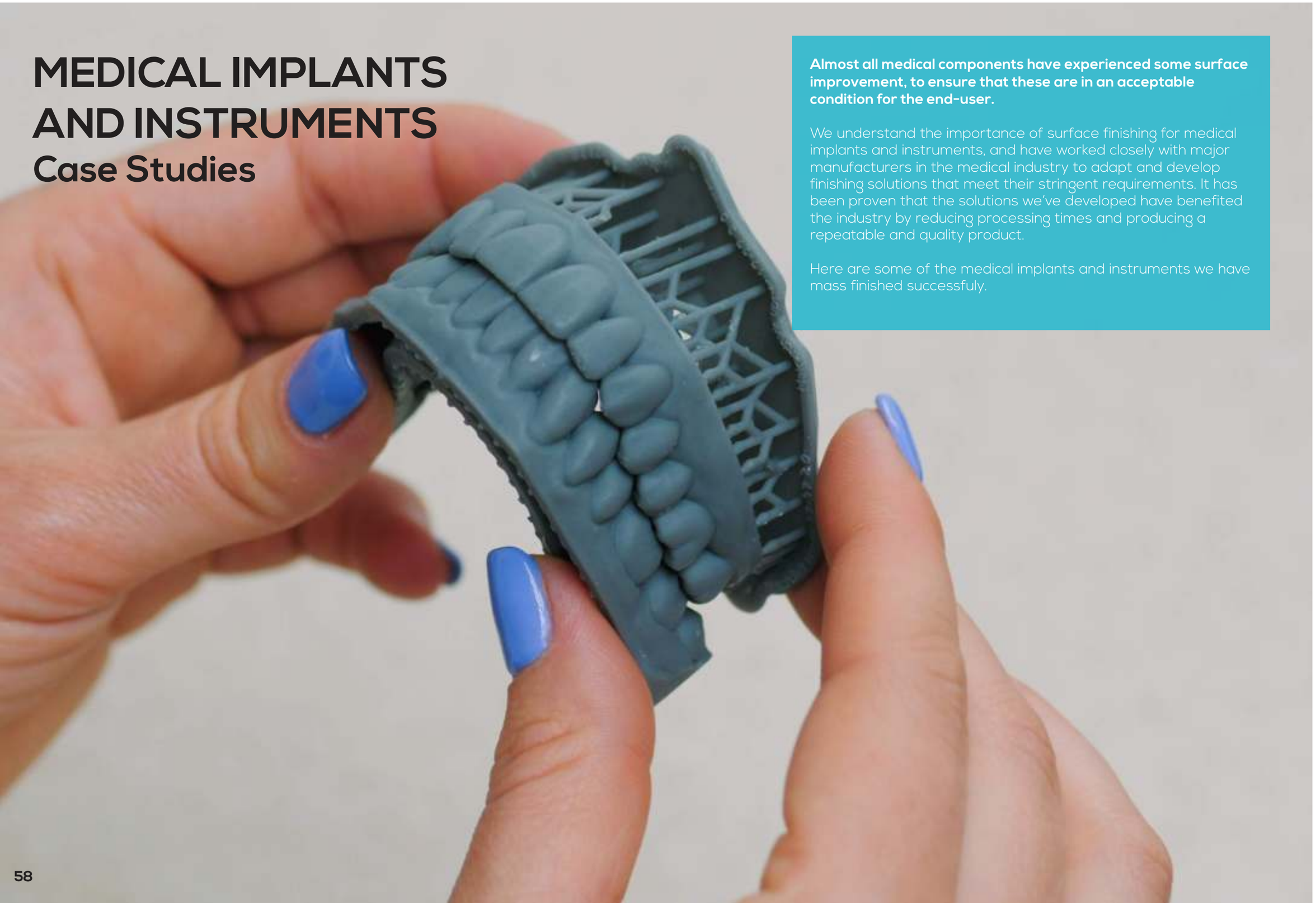
Cutlery is loaded into the parts feeder tray, which directs the parts into the bowl finishing machine. The cutlery is cleaned using a mix of polishing media, compound and water.

The cutlery is then dried in the unique elliptical-shaped vibratory drier using ActOn's specially formulated dust-free, heated agro media. This product is an excellent moisture absorbent media which also produces a stain-free polish effect.

Post-processing, all the parts are collected from the discharge chute of the drier into the portable unload cabinet. This cabinet can store up to 3 trays and is mounted on wheels to make it easily transferable.

MEDICAL IMPLANTS AND INSTRUMENTS

Case Studies



Almost all medical components have experienced some surface improvement, to ensure that these are in an acceptable condition for the end-user.

We understand the importance of surface finishing for medical implants and instruments, and have worked closely with major manufacturers in the medical industry to adapt and develop finishing solutions that meet their stringent requirements. It has been proven that the solutions we've developed have benefited the industry by reducing processing times and producing a repeatable and quality product.

Here are some of the medical implants and instruments we have mass finished successfuly.

CASE STUDY 1

Femur Implant . Mirror Surface Finish, Free of Defects.

The aim

A defect-free surface with mirror finish.

What we did

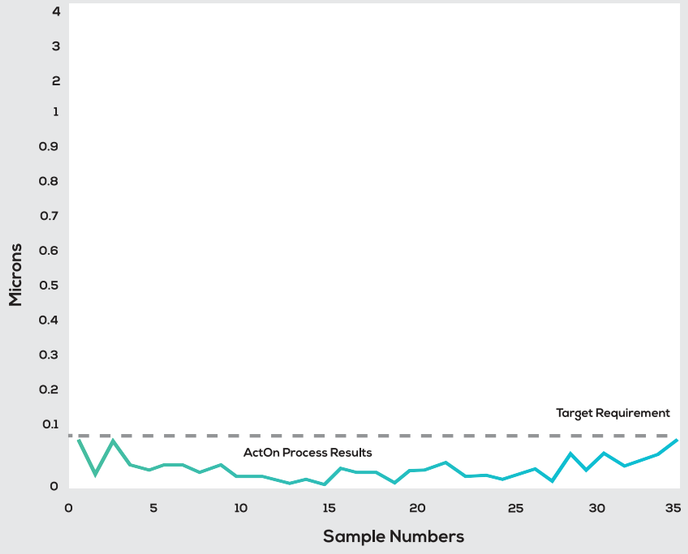
We achieved this with our three-stage process, using the ActOn High Energy machine, which combines grinding, smoothing and polishing. The process, developed by our team, has reduced the traditional processing time significantly. The unique design of the barrels eliminates the need for fixturing, whilst removing the risk of impingement. The flexibility of the machines allows the processing of different components, at different stages, using different media simultaneously. The machine and process delivers consistent results, with a superior surface finish. We also undertake removal of glass with our precision polishing expertise.

The result

The process delivered a superior surface finish in a considerably reduced time. The dimensional integrity of the part was maintained. A complete end-to-end solution.

Before

After



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CASE STUDY 2

Tibia Implant. Removing Machining Lines.

The aim

Our aim was to remove machining lines, without altering the dimensions and geometry of the part.

What we did

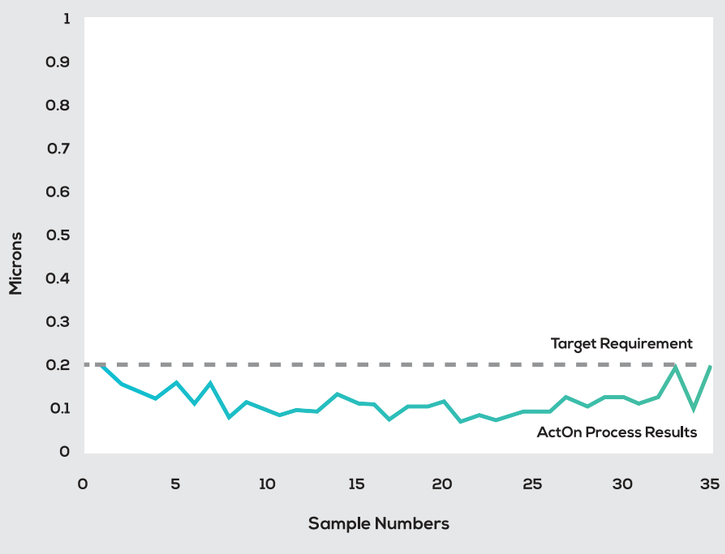
We achieved this finish with our single stage process, which generally takes 30 minutes, using our High Energy machines. Our team developed a unique process, using a single type of media that met the customer specification. The deep machining lines were removed, without affecting the dimensional integrity of the product. The media used provided the additional benefit of being able to get into the tight corners of the product, ensuring a consistent surface finish. In addition to a significantly reduced processing time. The process also eliminated the need for fixturing and the risk of impingement.

The result

Through the single-step process, the overall process time was reduced by 75%, and the machining lines were removed without affecting the dimensional integrity of the part. The results achieved are consistent with a uniform surface finish.

Before

After



CASE STUDY 3

Remove the Machining Lines & Polish Titanium Bone Implant

The aim

Deburr, remove the machining lines and polish titanium bone implant.

What we did

We developed single stage process which generally takes 1 hour. We finished the parts in the CHEF machine, with a mix of a medium abrasive plastic media, a concentrated liquid compound with good cleaning and polishing properties and water.

The result

- Machining lines were removed without altering the dimensions of the part.
- We offered repeatable and consistent results.

CASE STUDY 4

Deburr Stainless Steel Eye Clips.

The aim

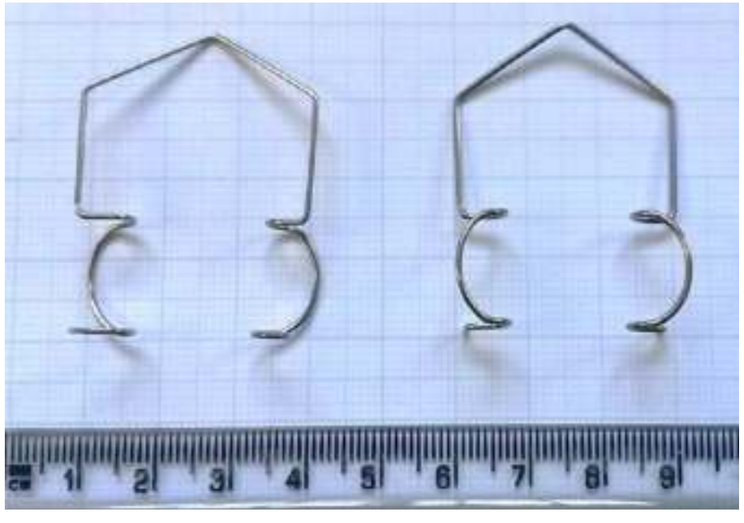
Develop a process and fixture to deburr 200 stainless steel eye clips per batch & avoid parts getting tangled during the process

What we did

Out technical team developed a custom fixture for the parts. Then we deburred the eye clips in ActOn vibratory trough machine, with a low abrasive ceramic media and an acidic compound designed for removal of scale, brightening and polishing suitable for ferrous metals.

The result

- Eye clips are deburred in approx. 60 min.
- Due to the fixture the components are uniformly finished
- There is no need to untangle these at the end of the process
- Repeatable and consistent results



CASE STUDY 5

Mirror Finishing Dental Partials.

The aim

The objective of this project was to achieve a mirror finish on Dental Partials.

What we did

One of the fastest ways to achieve a mirror finish in a 1 stage process, is by processing the parts in the DLyte Dental finishing machine,

DLyte Dental provides a surface finishing solution to the most common dental metal alloys. The dental applications for DLyte finishing technology range from grinding to high gloss polishing of dental parts. DLyte allows polishing of casting, sintered and milling parts.

The polishing action based on innovative dry electropolishing reaches every corner of the piece, so it can process inner cavities which can not be accessed mechanically.

The treatment does not require manual processing, reducing labor costs and eliminating the need to rework parts and the production of defective parts.

The result

Parts finish is highly polished without altering the dimensions of the part.

Before

After

Before

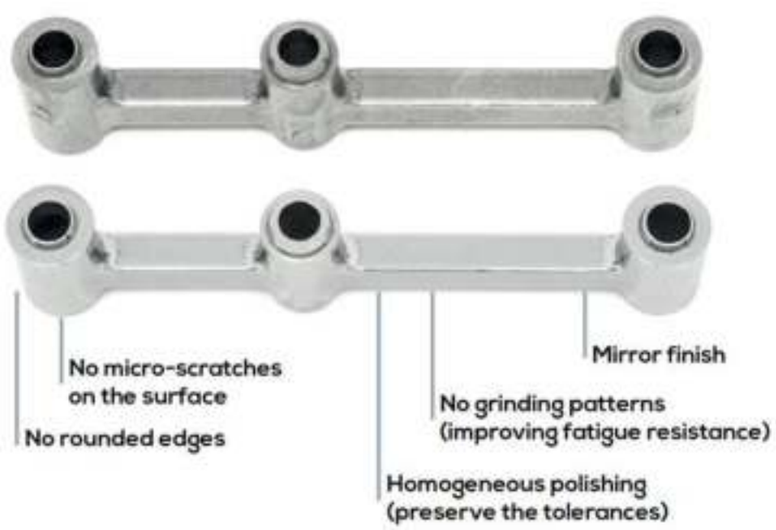
After

Other DLyte Finishing Results for

MEDICAL IMPLANTS & INSTRUMENTS

Ra: 1.16µm (before the dry electropolishing process)

Ra: 0.09 µm (after the dry electropolishing process)



Request Your Free
PROCESSING TRIAL TODAY

At ActOn Finishing we tailor our mass finishing products and services to suit your parts and finishing needs. For optimum and repeatable results we carry out the free trial and organise consulting sessions with our customers. These trials allow us to recommend the most suitable finishing machine, media and compound to achieve the finish required.

We carry out the free trial in our Research and Development department, where we can replicate vibratory finishing, centrifugal high energy finishing, shot blasting and precision polishing processes. Our technical specialists use various metrological equipment to ensure your finishing requirements are met.

Once you are happy with the final finishing process we will record all information in a data card. This includes the process parameters, inspection criteria and any other notes to ensure repeatability in results. Just contact us. We will do the rest.

Custom Project Development

1. Finishing needs: concept and goals
2. Assessment: we will carry out free trials using ActOn technology
3. Customized engineering development
4. Production phase
5. In-house validation
6. Commissioning

Don't just think about it.
It's now time to ActOn it.

WHAT OUR CUSTOMER SAY

" We purchased a CHEF machine from ActOn in 2019 to help with our capacity constraints on our internal deburring process. The professional service received from ActOn Finishing was invaluable especially throughout the qualification process. The purchasing of the CHE50 has increased our capacity by 200% while maintaining a quality product. "

Adam Cook, H.C. Starck Ltd.

"The CPM-10 has provided invaluable insight into finishing both EBM and SLM AM parts. This has provided the MTC with a low cost means to efficiently and effectively conduct R&D into surface finishing of additive manufactured parts."

Ruaridh Mitchinson, Research Engineer at The MTC

"ActOn were quick to develop a solution for the shell cleaning system. The vibro tumbler machine has improved our throughput significantly and we are pleased with the quality of machine that they have manufactured and installed. We look forward to working with ActOn on future collaborative projects."

Henry Illsley (Shell Process Engineer, Rolls Royce Bristol)

QUALITY YOU CAN SEE

We pride ourselves on our excellence, and over the years we have successfully demonstrated an ongoing compliance with ISO quality and environmental standards. We're also an approved supplier for many of our industries, including medical and aerospace.

For ISO, we currently hold:

CERTIFIED LR ISO 14001

CERTIFIED LR ISO 9001:2015

CERTIFIED LR AS 9100

MADE IN BRITAIN

We're proud members of the 'Made in Britain' campaign.

" The bitterness of poor quality remains long after the sweetness of low price is forgotten. "

Benjamin Franklin

ActOn FINISHING

we redefine

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