EXTRUDE HONE®

SHAPING YOUR FUTURE
Medical Applications by Extrude Hone

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MAKING THE WORLD SAFER, HEALTHIER & MORE PRODUCTIVE®

Medical is in Extrude Hone DNA

Designed by us

Extrude Hone has been in business since the 1960s, building on its proprietary technology, extrude honing, which has developed into what is more commonly known today—Abrasive Flow Machining. Along the way, additional technologies have been added to the portfolio offering, all designed specifically to improve the surface finish of your components.

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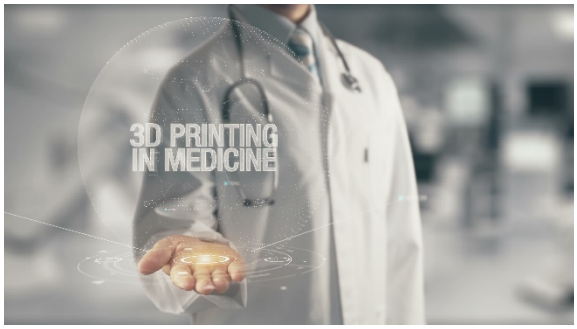
Success for 25 years

We have been processing medical components for over 25 years and have experience providing solutions to the healthcare, medical device, and pharmaceutical industries. We process FDA—and EU-cleared devices on our manufacturing sites and understand the complexity and associated quality requirements.



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2025 an ECM Breakthrough

Moving beyond finishing, Extrude Hone brings knee implant intercondylar area (box and cam) ECM machining to the market. It is fast, efficient, and cost-effective compared to CNC machining.

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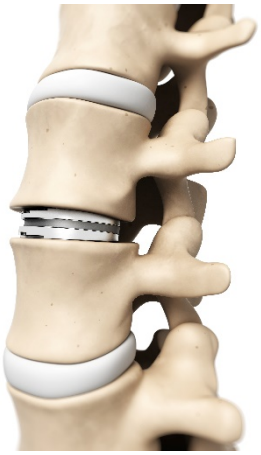
The Applications

Our diverse product range provide solutions to many medical and healthcare fields. Common applications include:

- Knee Femoral and Tibial Trays
- Hip Stems
- Fracture and maxillofacial plates
- Spinal implants
- Heart pump impellers and volutes
- Heart valves
- Biopsy instrumentation and needles
- Surgical Instrumentation – deburring, polishing and additive material removal
- Tube polishing, sourcing and supply for chromatography, pharmaceutical and food processing industries
- ION flow path processing for Mass Spectroscopy instrumentation



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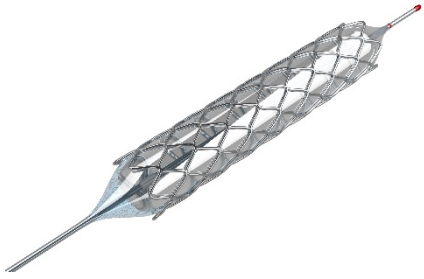

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2025, a breakthrough in Knee implant machining

Extrude Hone goes beyond finishing, with the ECM machining method applied to the knee implant intercondylar area.

In 2025, Extrude Hone introduces an alternative to CNC machining for the knee implant intercondylar area (the central box section, including the cam) between the bearing surfaces of the knee femoral.

Why should we machine the intercondylar area with electrochemical versus CNC machining?

Electrochemical Machining (ECM) is a cold, stress-free process that removes material up to 0.55mm (0.022in.). Regarding tolerances, dim. is within 0.1mm (0.004in.), and parallelism is within 0.05mm (0.002in.). Roughness can be improved below RA 0.2µm (8 Ra µinches).

With ECM, you can target the specific box and cam areas and do the roughing and the finishing in one pass.

ECM efficiency against CNC milling stays high for difficult-to-machine materials like CoCr. ECM dissolves that material like it would be stainless steel.

The outcome is a fast, efficient machining operation.

Compared to CNC, 90 seconds per knee (four of them simultaneously in a multiple-fold fixture) are required, while CNC will take 17 minutes per piece on average (machining and finishing time for the same area).

The difference in machining operation cost is enormous, 1.60 USD for ECM compared to 11 USD for CNC machining.

Knee Implant’s box and cam machining

ECM machining meets the knee femoral specification and guarantees product functionality.

Thanks to the cathode design, ECM permits targeted material removal at precisely defined locations.

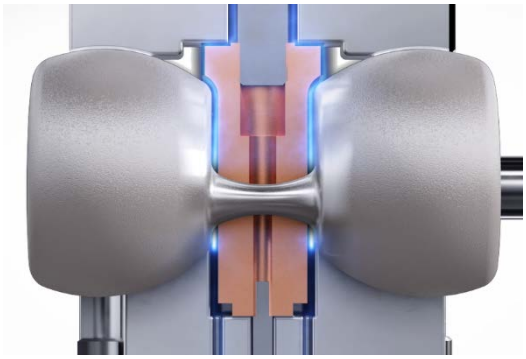
ECM brings many benefits to achieve superior quality under demanding requirements in a high-productivity environment.

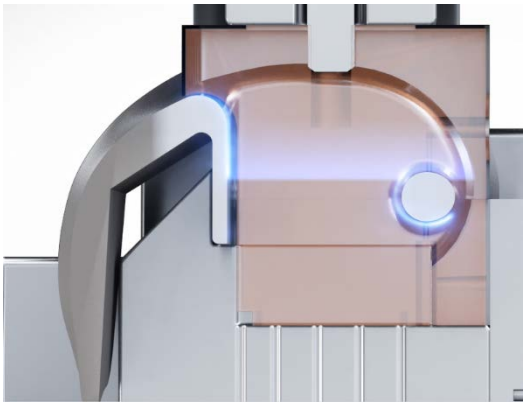
CHALLENGE

- Machining and finishing a complex area, the box, and the cam in hard material.

BENEFITS

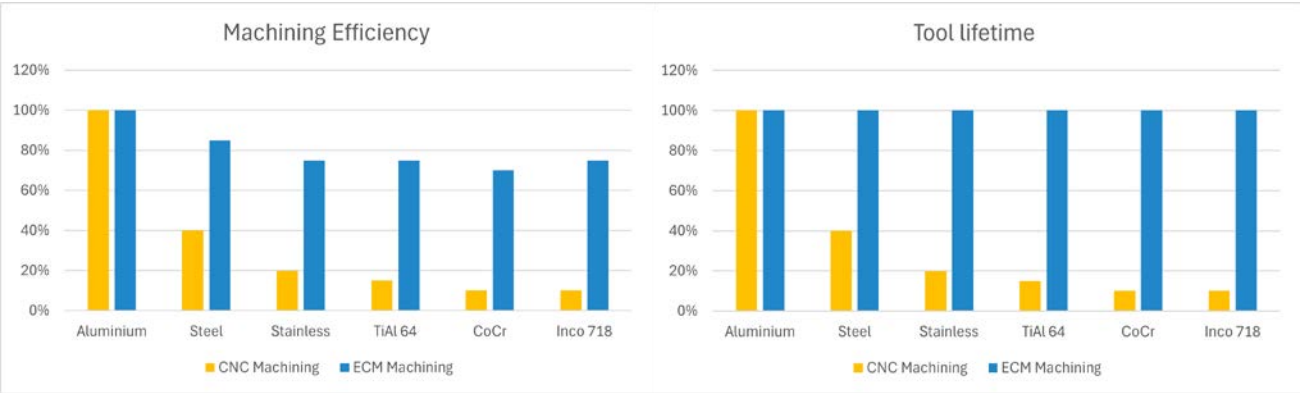
- Repeatable, reliable process.
- Independent of the material hardness
- Fast and efficient
- Tight tolerances and perfect roughness all at once.
- 6 times more cost-efficient than CNC machining





Knee Implant's box and cam machining

Head-to head efficiency comparison between CNC machining and ECM for different materials.



Head-to-head comparison between CoCr CNC machining and ECM.

	Conventional method	ECM
Machining	Time consuming (multiple steps ~ 12- 20 min/pcs) Tough to machine – high cutting tool consumption	Dissolves CoCr material like it would be standard Steel Due to the process, there is almost no tool wear
Finishing	Box finishing with hard-to-reach areas making machining is challenging Labor intensive, often including manual operation Inconsistent quality	No extra operation required, material will be removed & surface will be finished to a Ra 0,4µm/ Ra 10 µinch finish or better. Controlled process, consistent result
Productivity	Usually one / pcs. a cycle on multiple machines	Up to 4 pcs. a cycle as a standard
Total Cycle time / pcs	BOX & CAM ONLY! Machining: 5 – 10 min/pcs. Finishing: 7 – 10 min / pcs Total 17min/pcs as an average	BOX & CAM ONLY! Machining & Finishing: 6 min/cycle Total 6min @1-fold vs. 1,5min@ 4-fold
Outside finishing	Done in a separate operation	Done in a separate operation after ECM
Running Cost	High due to tough material machining, usually > 10€/ pcs. (11USD/pcs).	Low, as material toughness does not matter 1 to 1,50 €/pcs. (1.10 to 1.60USD/pcs)

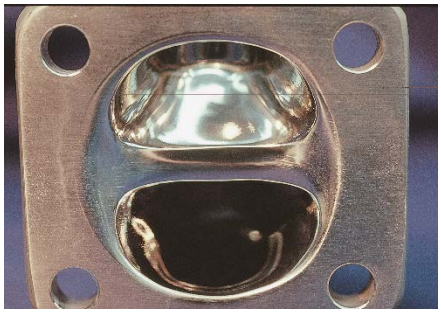
Surface matters,
Finishing Methods as well.

Extrude Hone finishing methods

Depending your finishing requirements, the component geometry, material and the manufacturing process we have solutions for you.

Surface Finishing and deburring

Abrasive Flow Machining is the mainstream process already qualified on numerous Medical Devices which are FDA approved, most of them being implantable devices.



MICROFLOW belongs to the same family, and it is now available in a high flow variation should be considered if you have small passageways to be polished.

Electrochemical Machining/Deburring (ECM /ECD) is a deburring and edge radiusing technology. Electrochemical machining is a method that finishes the workpiece surfaces by means of anodic metal dissolution.

COOLPULSE is a new alternative. COOLPULSE Surface improvement give similar results to that of electropolishing but can focus its machining area and do this without harmful acids. This can also be carried out on titanium alloys (limited grades).

TEM - when required a Thermal Energy Method may be adopted to remove burrs, flashing and unwanted material in milliseconds.

From standard deburring to Micro deburring, TEM, AFM and COOLPULSE could be the solution.

Additive structure removal, TEM specific application could be a very productive way to eliminate construction supports.

Cardiovascular Components

Hydrodynamic similarities aid cardiovascular device manufacturers

Cardiovascular components are required to function first time, every time, as patient welfare relies on them. Cardiovascular manufacturers design and manufacture components to ensure that their components benefit rather than harm the patient.

In order to improve the quality and efficiency of their cardiovascular component's manufacturers have introduced abrasive flow machining to improve and maintain consistent functionality.

The fluidic properties of AFM follow a similar path to that of blood, flowing through and around a component whilst smoothing and radiusing the surface. This fluid shaping ensures that the blood flow isn't hindered and that cells are not damaged.

CHALLENGE

- Complex deburring of small hydraulic modules.

BENEFITS

- Reduces surface roughness of cannular tubes.
- Consistent results guarantee quality.
- Fluidic shaping.
- Helps prevent damage to blood cells.

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Prosthetics

Guarantee prosthetic functionality with AFM

Prosthetic devices have given patients with reduced mobility the confidence and ability to carry out everyday activities.

Although to the naked eye these can seem simplistic in design, they often incorporate complex hydraulic actuation. The ability to accurately compensate for musculoskeletal changes in natural anatomy and allow the prosthesis to mimic limbs better.

In order to maintain functionality, it is vital that the manufacturing quality of the actuation module is reliable and repeatable.

CHALLENGE

- Complex deburring of small hydraulic modules.

BENEFITS

- Repeatable, reliable process.
- Reach hard-to-reach areas, even without line-of-sight.
- Parts 100% free from burrs.

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Knee Implants

Anatomic restoration made possible using AFM

Restored large joint anatomy allows patients to regain mobility and return to day-to-day activities.

The modern-day knee arthroplasty has remained fundamentally the same since the 1970's, improved by technological advancements in manufacturing, material development as well as implantation approach and accuracy.

During this time Extrude Hone has been called upon to provide surface finishing techniques to both the condyle surface as well as the central box section between the bearing surfaces of the knee femoral.

The uniqueness of Extrude Hone' technology means that you are able to polish areas unachievable by conventional methods. This is prevalent in more modern devices and especially those that are additively manufactured.

To maintain implant functionality it is vital to ensure quality and repeatability of processes. Abrasive flow machining can ensure that the bearing surfaces of the knee femoral meet specifications and guarantee product functionality.

CHALLENGE

- Complex polishing of curved surfaces.

BENEFITS

- Repeatable, reliable process.
- Reach hard-to-reach areas, even without line-of-sight.

Spinal Implants

Intricate component deburring using AFM

Back pain is seen as one of the biggest contributors to patient disability worldwide. The main influencer being general wear and tear, sometimes there are more specific cases such as sciatica and disease. As a precursor, occupational therapies like chiropractic adjustment or acupuncture will be used but some cases will eventually require surgical intervention.

The intricacy of these micro machined parts often call for post processing to remove burrs and sharp edges from the implants. In order to mimic the spinal anatomy some implants are designed to allow micro motion. To avoid premature implant wear and failure, contact surfaces designed to move benefit from being post processed by abrasive flow machining. A high-quality surface finish on moving contact surfaces reduce abrasion and improve implant longevity.

To maintain implant functionality it is vital to ensure quality and repeatability of processes. Abrasive Flow Machining can ensure that spinal implants meet specifications and guarantee product functionality.

CHALLENGE

- Complex polishing of micromachined components.

BENEFITS

- Repeatable, reliable process.
- Reach hard-to-reach areas, even without line-of-sight.

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Ion-Block for Mass Spectroscopy machines

High quality surface finish can improve machine accuracy

Mass Spectroscopy machines are used in a wide range of industries but mostly known within the food, drug and medical sectors.

The process takes a solid, liquid or a gas sample and uses electrons to bombard the material to create ions. These ions are then separated within the mass spectroscopy machine and analyzed on a molecular level to understand the makeup of the sample.

With the analyzers the ions are transported using electro or magnetic fields. The flow of ions within the machines pass though many guides, gates and passages to direct the material to the next stage of the process.

Improving the surface finish of components that are in direct contact of the ions improves and smooths out flow, gives more direction and can improve the accuracy of the results.

Extrude Hone abrasive flow machines can polish these complex components to give superior results.

CHALLENGE

- Complex surface polishing.

BENEFITS

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- Greater accuracy
- Reach hard-to-reach areas, even without line-of-sight.

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Chromatography Tube

HPLC tube solutions for accurate results

High pressure liquid chromatography (HPLC) is used for separating a mixture and quantifying each component within it. Often the process happens within a cannular tube usually referred to as a Column or a Cartridge.

HPLC is used throughout pharmaceutical world as well as analyzing and monitoring glucose levels within the blood.

AFM process is used to polish the internals of the cannular tubes ensuring the accuracy by providing a repeatable micron level surface finish. The smooth, consistent finish achieved by the AFM process improves the separation characteristics of the process and is critical to its function.

CHALLENGE

- Improve surface finish of internal surfaces of the tube for better fluid separation.

BENEFITS

- Reduced surfaces roughness of cannular tubes.
- Consistent results guarantee quality.
- The smooth consistent finish improves the separation characteristics and makes the results clearer.

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Stents

Stents are micro tube structures placed inside blood or other fluids passageway to aid healing or relieve obstruction.

The tubes come in biocompatible material, like 316LVM and cobalt alloys, along with tight dimensional accuracy, very smooth ID – OD and laser cut. They are either balloon inflatable or self-expandable.

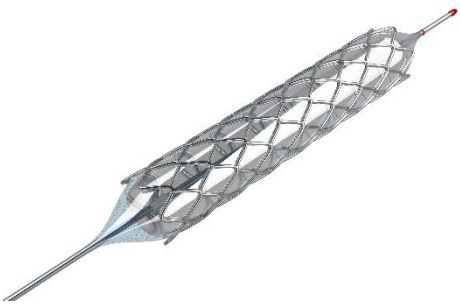
Using Abrasive Flow Machining (AFM) as a preliminary tube surface preparation helps paving the way for success following processes like electropolishing.

CHALLENGE

- Achieve efficient internal surface improvement.

BENEFITS

- Reduced surfaces roughness of cannular tubes.
- Consistent results guarantee quality.



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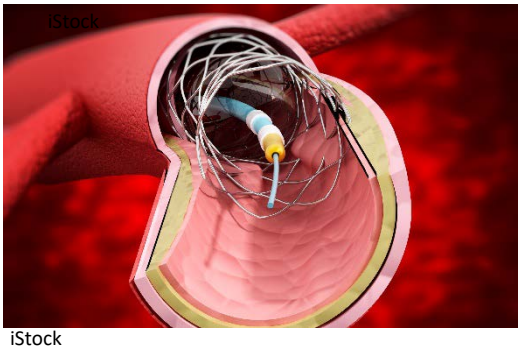

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Medical Tubing

High quality tubing supplied and finished by Extrude Hone

Healthcare, pharmaceutical and medical device industries require tubing that is superior that what most suppliers can offer. In some cases tubing may need to be specifically manufactured at the mill especially when seamless tubes are required. Once the raw material is obtained some manufacturers have internal surface finish requirements that is sometimes only achievable using Extrude Hone processes.

Extrude Hone has over 25 years of experience in processing tubing for high spec applications and pride ourselves in often being the only point of call in internal tube processing. Not only this but Extrude Hone work directly with tubing manufacturers and can supply your specific requirements straight from the mill, post process to your required internal Ra , clean, pack and ship to your door.

Some of the tubing applications that we supply are used to manufacture Stents, Chromatography tubes, Surgical Instruments for Ophthalmic and Biopsy industries, Food preparation, Pharmaceutical processing and many more.

The surface finish requirements of each application varies but we are able to supply internal polishing down to 0.6um Ra and over a length of up to 500mm.

CHALLENGE

- Complex polishing.

BENEFITS

- Repeatable, reliable process.
- Reach hard-to-reach areas, even without line-of-sight.

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Surgical Instrumentation

Instruments are often thought of as simple disposable devices used every day in surgery such as a scissors or a scalpel. Although simple disposable instruments are used in most cases, they make up less than 5% of the total number of instruments used for example in a Hip or Knee instrument set.

These more complex instruments are specifically designed to function with the corresponding hip or knee replacement. The quality and reliability of the instrument is just as important as the implant as one cannot function without the other. An instrument mal function could also lead to an increase operating time, which is sometimes a reportable event.

COOLPULSE™ can be used to improve the surface finish of instrumentation, reducing surface roughness and removing stress risers. It can also be used to smooth sharp edges as well as remove burrs to ensure the sterility of the instrument is retained.

CHALLENGE

- Remove burrs and sharp edges.
- Ensure sterility.
- Improve mechanical properties by removing stress – risers.

BENEFITS

- Increased device reliability.
- Reduced risk of unsterile Components.
- Reliable and repeatable finishing.
- Capable of internal and external features even on complex geometries.

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Proximal Fracture Plate

Burr removal and edge finishing solution for an implantable device

Implantable devices have changed the face of the healthcare industry since their introduction in the 1950's.

Device quality is paramount as these devices are clinically invasive and patients often rely on them for mobility and sometimes even as a life support. Most implantable metallic devices are manufactured from grades of Titanium or Stainless Steel due to their corrosion resistance and biocompatibility.

Some medical devices are intricately shaped due to their location, which increases the complexity when it comes to edge finishing. Manufacturing processes leave behind unwanted burrs and sharp edges that can negatively impact the mechanical properties of components leading to reliability issues during the product's life cycle. In addition, the sterility of implantable devices may be compromised if there are sharp edges on the device.

Extrude Hone's Abrasive Flow Machining removes burrs and sharp edges from internal and external features which will improve the quality of implantable medical devices.

CHALLENGE

- Remove burrs and sharp edges.
- Ensure sterility of implants.
- Improve mechanical properties by removing stress – risers.

BENEFITS

- Increased device reliability.
- Reduced risk of unsterile components.
- Reliable and repeatable finishing.
- Capable of internal and external features even on complex geometries.

Tablet Press Tooling

Pills are critical in nowadays' s medicine. Get the Tablet Press Tooling right is key to get the pill itself right and the best productive manufacturing. A Pill press down is a hard pill to swallow as you know.

Abrasive Flow Machining is one process use to achieve the superior surface finishing on the punch press barrel extremity and in the dies passage.

Depending on the application and on the treating and coating AFM will be used or not.

Same for the manufacturing of the punch die shape itself, PECM (Precise Electrochemical Machining) could be used if conventional machining reach a limit.

CHALLENGE

- Surface Super finish .
- Demanding tolerances.

BENEFITS

- Perfect product shaping.
- Reliable and repeatable finishing.
- Capable of internal and external features even on complex geometries.

Source: Natoli Engineering

Ball Screws for Medical Beds

For most of us a Medical Bed is not that much than a fancy expensive bed till we must rest in it.

Medical beds can be very high tech as including connectors for fluids, protocol reminder with multiple HMI, WIFI capabilities and fully electric motion at a fingertip including possibility to move the patient from horizontal to vertical position.

Medical bed smooth motion is part of the comfort of the patient who are already in deep pain. The ability to adjust the height of the bed to facilitate moving patient in and out the bed is a great support for nurses who do this hundred times a day.

Looking specifically at motion, ball screws are used to ensure electric powered smooth motion. Cleanliness of a ball screw is critical to ensure absence of failure, smooth motion and no wear.

ECM process are applied to the thread section of the ball screws but also the nut. Extremity of the thread, and nut recirculation intersection areas must be micro-burrs free Nice radius could be added to improve quality even further.

CHALLENGE

- Surface Super finish and radius generation.
- Demanding tolerances.

BENEFITS

- Perfect product shaping.
- Reliable and repeatable finishing.
- High productivity for controlled cost.

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Finishing Ventilator components

As we all know, ventilators have been on high demand during Coronavirus COVID-19 outbreak.

Some of the intricate components in contact with the fluids require to be perfectly clean.

TEM process is used to remove burrs and micro-burrs from parts. This was the process of choice to ensure that no contaminants are left in this critical ventilator component. Some of them have multiple cross hole intersections with thread. TEM is removing not only burrs from the machining operation but also any particle left.

As Thermal Deburring comes with a high productivity, cycle time being seconds, Extrude Hone was able to ramp up drastically TEM finishing production to respond immediately to the high demand on ventilators.

CHALLENGE

- Remove burrs at intersecting holes
- Eliminate micro-contaminants on all internal and external surfaces

BENEFITS

- Automated process with accurate, consistent and repeatable machining
- High productivity for controlled cost.

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Additive in Medical - The Bigger Picture

Additive manufacturing has taken the industry by storm, once complicated multi piece or multiple operation components can now be created in one step. The drawback of which is that components that require a high-quality surface finish or precision features need additional operations to machine and finish the part. In addition, the build process can also leave support structures that need to be removed prior to machining and leave behind partly sintered or partially bonded powder material on the surfaces.

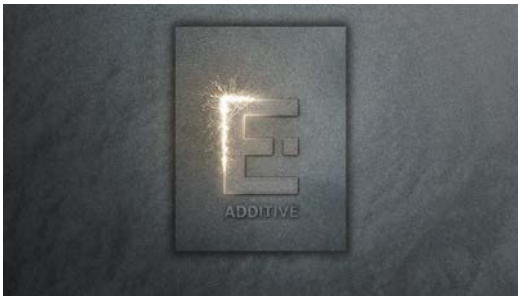
This scenario is particularly unwelcome in the implantable medical device and instrumentation space. Rough, as printed surfaces could trap contaminants on the surface of the part. Unwanted free movement of particles that have become unbonded from the surface can cause huge complications within the body. Loose metallic particles could cause implants to be rejected by the body, cause infection and require revision surgery. Instruments that are used to position the devices also fall under this category as these are often used within the incision.

CHALLENGE

- Surface finish requirements for additively manufactured medical components.

BENEFITS

- Removal of partially sintered or bonded material.
- Support structure removal.
- Smooth surfaces reduce harboring of bacteria.



Additive finishing techniques

What's the best technology for finishing of AM Medical parts?

There is no universal answer to this question. There are many challenges, which differ from part to part. Sometimes components are less complex in shape and can be finished using more conventional techniques. Others are near net printed and conventionally machined to achieve the desired finish. However, when developing a true additive part, typically having been through a design for additive manufacture (DFAM) process, component features may not be reachable using conventional methods.

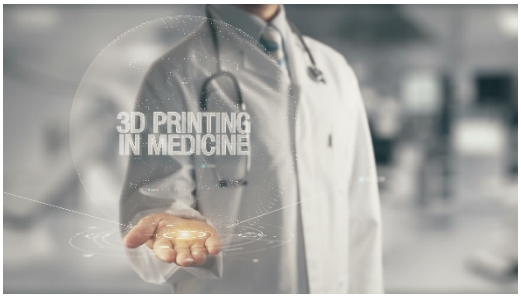
Extrude Hone realizes this and has developed techniques using Abrasive Flow Machining (AFM) for internal channels, as well as non-contact electrochemical COOLPULSE for both internal and external finishing of additive components. Both techniques have been independently documented as exemplary methods of removing partially-sintered and bonded material from the surface.

CHALLENGE

- Surface finish requirements for additively manufactured medical components.

BENEFITS

- Removal of partially sintered or bonded material.
- Support structure removal.
- Smooth surfaces reduce harboring of bacteria.



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Equipment or Contract Shop, your pick

Extrude Hone supports customer in the Medical fields in various ways:

Feasibility – Testing

- Test different technologies or a combination to find the perfect solution tat suits their needs
- Test structure removal using TEM - different structures require different approaches.

Contract shops

- No need to invest - we have contract shops that can do the job for you, some process FDA approved devices like in Irwin PA.
- Leverage finish3D capabilities a combination of Extrude Hone processes with MMP technology

Equipment

- Want to keep the process a secret, bring machines to your location
- The full equipment portfolio is for sale. We will support during ramp-up and we will be beside you for service and consumables in the long term.

Industry Experience

Linx, Blatchford's integrated limb system, is designed to deliver an experience that mimics the incredible and complex structure of the human leg compromising a knee and foot/ankle joint. It provides a coordinated stream of instructions to the hydraulic and pneumatic support system by actively sensing and analyzing data on the user's movement, activity, environment and terrain. The result is a walking experience that is closer to nature than ever before, giving the user the confidence to get on with their life.

Blatchford's Manufacturing Department, based in Basingstoke, has an Extrude Hone EASYFLOW machine, an Abrasive Flow Machining (AFM) system, which deburrs the intersecting passages to ensure a smooth flow of hydraulic fluid in their Orion3, microprocessor-controlled knee (MPK), and Linx to provide the user with smooth joint function.

Ian Keeley, Manufacturing Engineering Manager at Blatchford, commented:

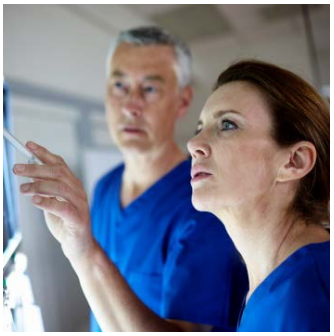
"We purchased the system to give increased control over the process and the lead-time. Since bringing this in house, we have reduced the overall lead-time by around 20%. It has also given us the ability to experiment with this process on other components – something not so easily done when the process is outsourced."

The machine removes the human element of the internal deburring and gives consistent material removal, a quality that is essential for Blatchford and their medical devices.

Source: Blatchford



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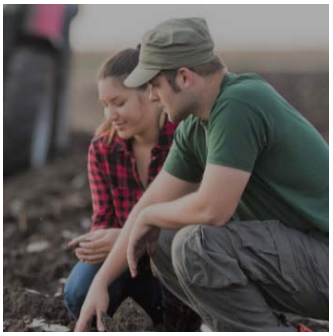


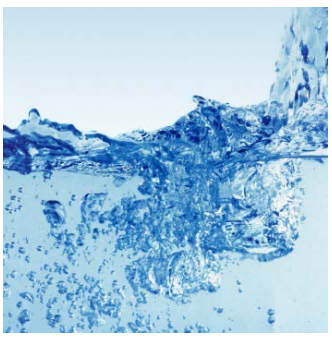



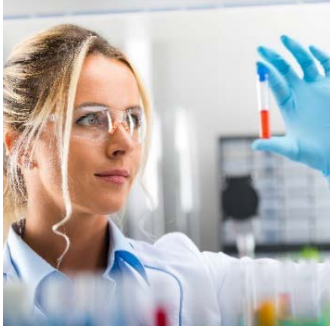


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