



Ti6Al4V MEDICAL

CASE STUDY
ELECTROCHEMICAL POLISHING

THE CHALLENGE

Holdson was approached by a leading company in the medical sector who was seeking to enhance the surface quality of titanium parts. Made from Ti6Al4V and produced through additive manufacturing, it is critical that these components are smooth with no residual powder for biocompatibility. However, achieving the required surface finish using conventional methods presented challenges, as they involved lengthy cycle times, hazardous chemicals, and a high-risk operating environment.

The customer saw substantial value in additive manufacturing (AM) for producing components with complex geometries and reducing material waste. AM enables the design of intricate titanium parts within faster turnarounds. However, as-printed AM parts inherently have a rough surface finish, acting as a barrier to fully embracing AM as a manufacturing method.

For this customer, the roughness of the as-printed titanium parts required extensive post-processing to meet the strict quality standards demanded in med-tech, especially for implants. This high level of post-processing negated many of the cost and time-saving benefits of AM, making it difficult for the customer to justify a full transition away from conventional manufacturing.

Other methods the customer explored for post-processing were time-consuming, hazardous, and cost-intensive, often involving manual polishing or machining. These processes created operational bottlenecks and posed safety risks, particularly due to the use of toxic chemicals. Seeking a more efficient and environmentally-friendly solution, the customer turned to Holdson's electroform™ technology, in an effort to overcome the limitations of AM and existing post-processing methods.

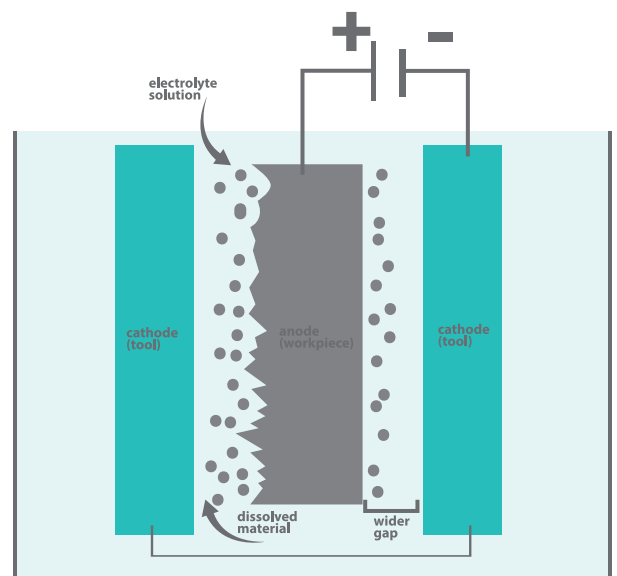
Input surface finish	10.95 μm
Manufacture method	SLM printed
Material	Ti6Al4V
Weight	CONFIDENTIAL
Dimensions	CONFIDENTIAL
Required output surface finish	<2 μm
Required processing cycle time	<60 minutes

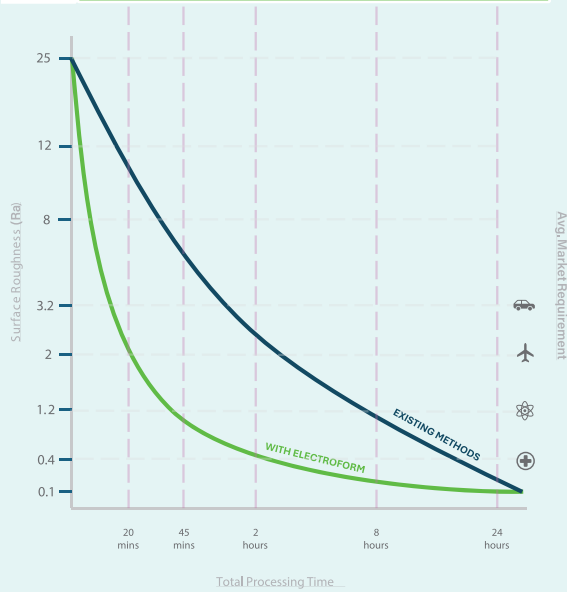
THE SOLUTION

Due to the customer's need for efficient processing times and repeatable, uniform results, as well as the desire to avoid harsh chemicals, electroform™ stood out as a solution to the challenges they were experiencing.

Holdson's technology leverages advanced computational fluid dynamics (CFD) to deliver consistent, high-quality finishes on complex geometries, making it ideal for intricate titanium medical implants. This process improved the surface finish without damaging the structural integrity of the implant, enhancing both the component's functionality and durability.

The implant was polished in Holdson's ef-150 machine using its ef-Ti electrolyte fluid, which is custom formulated for enhanced material removal on titanium parts. After uploading the CAD model of the part to the machine's control system, the part was submerged in the electrolyte bowl. During the machine cycle, the electrolyte solution is agitated by the machine's advanced CFD (Computational Fluid Dynamics) technology, which calculates an optimised fluid flow informed by the parameters determined by the control system. This results in uniform material removal from the component.





Holdson's process allows for the acceleration of processing times, reducing cost and increasing throughput of post-processing for metal components.

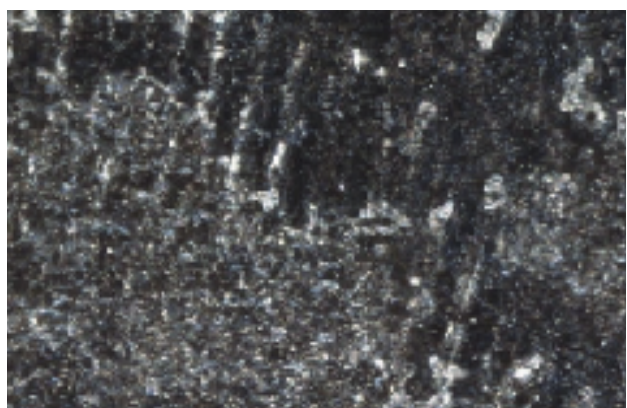
Compared to traditional steps and competitors, Holdson's system can take a metal component at any input roughness and provide a rapid surface improvement within 20 minutes.

THE RESULT

PRE POLISH MICROSCOPE



POST POLISH MICROSCOPE



Holdson successfully reduced the customer's titanium implants' surface roughness from an initial 10.95µm to a polished finish of 1.19µm, achieving the desired results with a 65% reduction in process cycle time compared to the customer's current method.

Input surface Roughness	Output surface Roughness	Required cycle Time	Actual cycle Time
10.95 µm	1.19µm	<60 minutes	20 minutes

The functionality of the medical implant was enhanced by reducing surface roughness to a level that optimises biocompatibility and integration with human tissue. The smoother, more uniform surface reduces the risk of bacterial adhesion, enhances the implant's compatibility with surrounding tissue, and promotes better osseointegration, all of which are essential for the safety and longevity of medical implants in the body.

To experience the results of electroform™ for yourself, contact us today at: sales@holdson.co.uk.