

AlSi10Mg AUTOMOTIVE

CASE STUDY
ELECTROCHEMICAL POLISHING

THE CHALLENGE

In the competitive automotive industry, optimising fuel efficiency is crucial for reducing emissions and meeting regulatory standards. Current post-processing techniques for additively manufactured automotive components, are very often inadequate to contribute to the levels of engine performance and fuel efficiency demanded by today's stringent regulatory requirements.

Holdson was approached by a prominent automotive OEM which manufactures a vital engine component from AISi10Mg aluminium alloy using additive manufacturing (AM) techniques. The as-printed surface of the part exhibited a roughness of approximately 6.6 μm Ra, with semi-sintered powder particles adhering to the surface. This unevenness was leading to issues with fuel flow, hindering the component's performance. The customer had already tried mechanical post-processing techniques to smooth the part, but these methods were inconsistent, time-intensive, and ultimately unable to achieve the desired level of refinement.

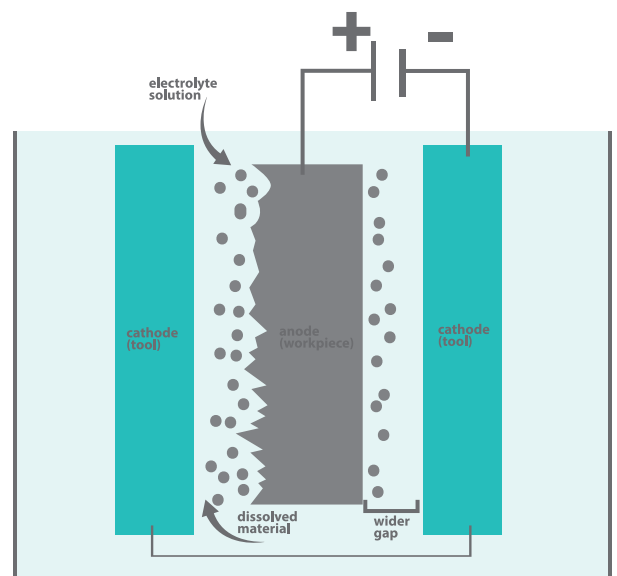
Through a collaborative process of analysing the customer's requirements, it became clear that for optimal performance, it was essential that the component's internal surfaces were smooth, as any roughness or residual semi-sintered powder could disrupt fuel flow and thereby reduce efficiency.

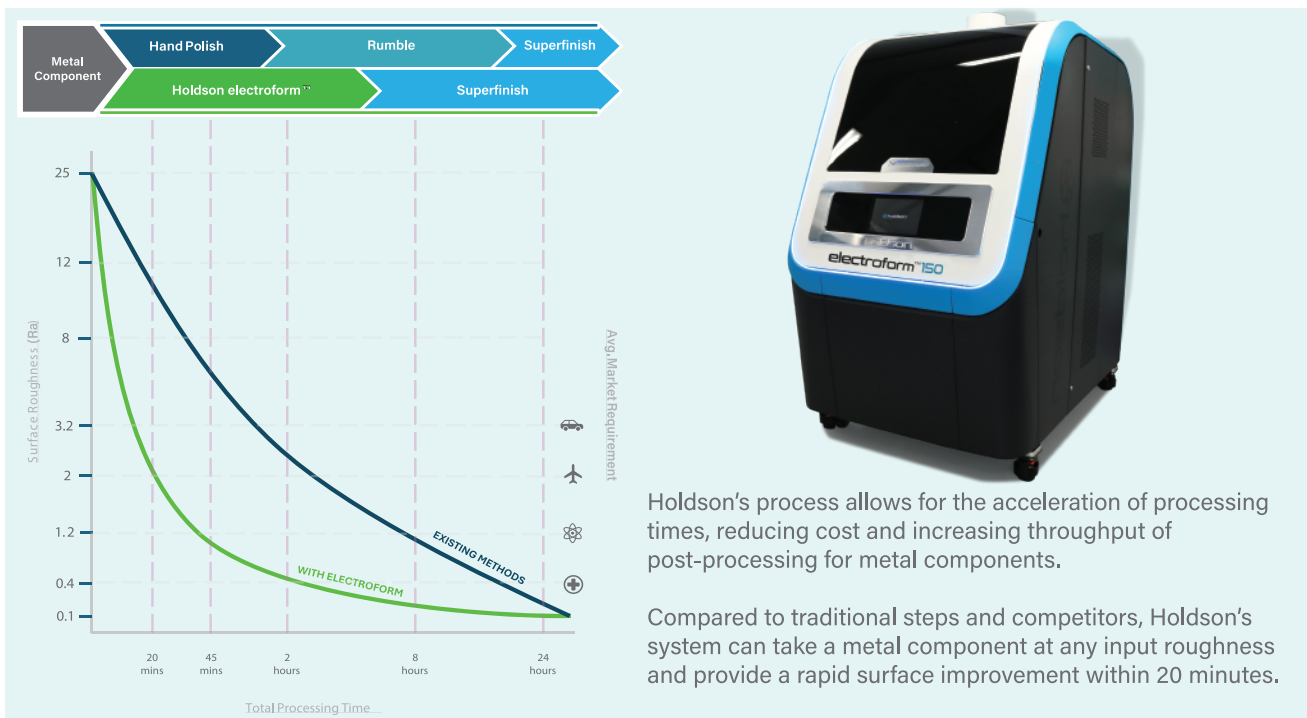
Input surface finish	6.6 μm Ra
Manufacture method	SLM printed
Material	AISi10Mg
Weight	CONFIDENTIAL
Dimensions	CONFIDENTIAL
Required output surface finish	<3 μm
Required processing cycle time	<60 minutes

THE SOLUTION

Due to the customer's need for uniformity, repeatability, and reduced cycle times, Holdson's electroform™ electrochemical polishing technology was identified as the ideal solution. This process leverages electrochemical principles to achieve consistent, high-quality finishes on complex internal geometries, making it particularly well-suited to intricate AM components in automotive applications.

The component was polished in Holdson's ef-300 machine using its ef-Al electrolyte solution, which is custom-formulated for enhanced material removal on aluminium parts without inclusion of harmful chemicals. 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.



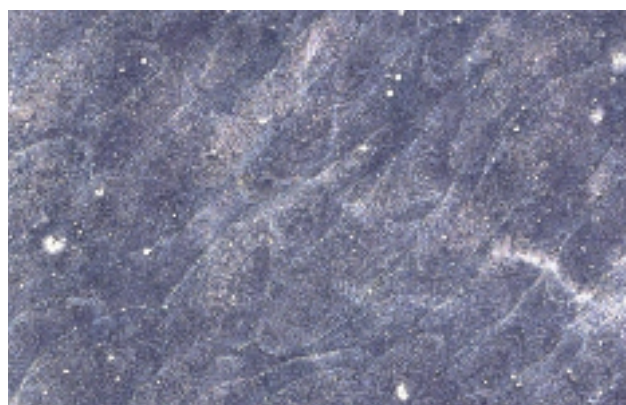


THE RESULT

PRE POLISH MICROSCOPE



POST POLISH MICROSCOPE



electroform™ was able to polish the AlSi10Mg engine component without abrasive mechanical processes or harsh chemicals. In this case, the technology effectively removed the semi-sintered powder and smoothed the surface, eliminating friction points that would otherwise disrupt fuel flow. The process achieved the required surface finish in a 25-minute cycle time. This represented a 2/3 reduction in cycle time compared to the post-processing methods previously employed by the customer, meeting their demand for processing efficiency without compromising quality.

electroform™ successfully reduced the surface roughness of the customer's AlSi10Mg engine component from an initial 6.6 μm Ra to a polished finish of 2.2 μm Ra, to meet the specified quality standards.

Input surface Roughness	Output surface Roughness	Required cycle Time	Actual cycle Time
6.6 μm Ra	2.2 μm Ra	<30 minutes	25 minutes

By reducing the surface roughness, the functionality of the component was significantly enhanced, allowing for smoother gas and fluid flow, which are critical requirements for optimising fuel efficiency.

The uniform surface finish achieved with electroform™ reduces friction and energy loss, ensuring consistent and reliable performance under demanding automotive conditions. This improvement supports the industry's drive for better fuel economy, helping manufacturers to meet stricter emissions standards and to reduce operational costs.

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