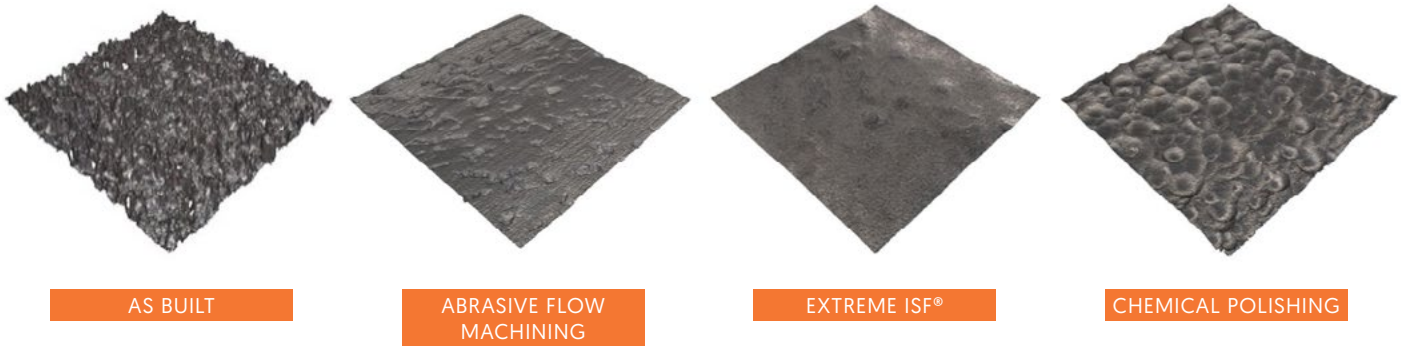
Market Sector:
AEROSPACE

Technology Theme:
ADDITIVE MANUFACTURING / SURFACE FINISHING

INTERNAL FINISHING FOR ADDITIVE MANUFACTURING (CRP): A REVIEW OF INTERNAL FINISHING TECHNIQUES FOR COMPLEX INTERNAL AM FEATURES

Example Ti6Al4V Feature AM Surfaces - 5mm Diameter Channels



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EXPERIMENTAL TRIALS AND SIMULATION DEVELOPMENT FOR AM INTERNAL FINISHING PROCESSES

The MTC assessed the capability of various techniques to finish a variety of internal features in AM parts, both through experimental trials and a literature review. Further to this, the MTC developed and validated an abrasive flow simulation for the prediction of surface roughness values.

> The Internal Finishing for Additive Manufacturing (AM) core research program provided a good foundation to the characterisation of internal finishing processes and their capabilities across AM.
>
> **Tony Newman, Principal Engineer, Parker Aerospace**

THE CHALLENGE

A lack of availability and knowledge of finishing techniques for complex additively manufactured components remains a barrier for the wide scale uptake of AM technology in industry.

In particular, internal features in AM components pose a problem as access with traditional tools is much more difficult and features without line of sight cannot be finished using conventional processes.

The overall aim of this internal finishing core research project (CRP) was to assess the capability of various techniques to finish a variety of internal features in an AM part, and therefore aid the members in the consideration and selection of appropriate finishing processes.

MTC'S SOLUTION

- A review and down selection identifying more than 15 suitable finishing technologies.
- A comprehensive series of trials of the three different post processing methods down selected was conducted, on Ti6Al4V and AlSi10Mg representative components.
- Development of a physics model to complement the abrasive flow experimental trials; iteratively refined by using the experimental data as inputs.

THE OUTCOME

- The advantages and limitations of more than 15 finishing processes have been theoretically identified through a literature review.
- The advantages and limitations of three finishing processes have been identified through experimental trials on various complex internal features of multiple materials.
- Process specific 'design rules' have been generated.
- An abrasive flow simulation that can be used to predict surface finish and process parameter requirements has been developed and validated.

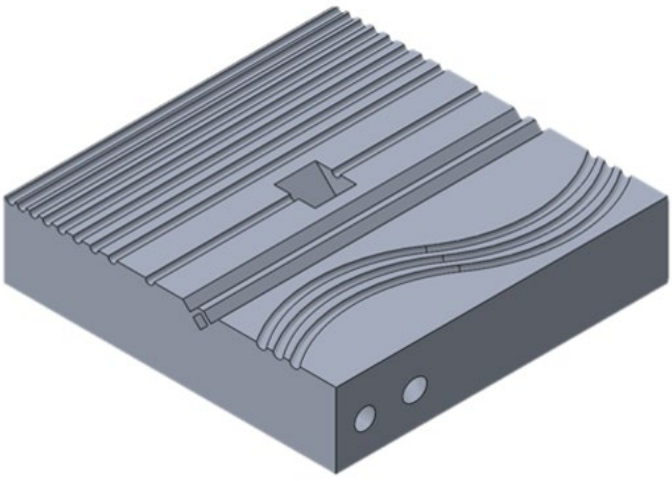
BENEFITS TO THE CLIENT

- The production of process specific 'design rules' to utilise in future during the AM design stage. These can improve the finish achieved on components by tailoring to the advantages and limitations of each finishing process trialled.
- Experimental knowledge gained on the following finishing processes:
    - Extrude Hone Abrasive Flow Process
    - REM Isotropic Super Finishing (ISF)
    - Poligrat Chemical Finishing.
- Theoretical knowledge gained of 15+ finishing technologies suitable for internal features.

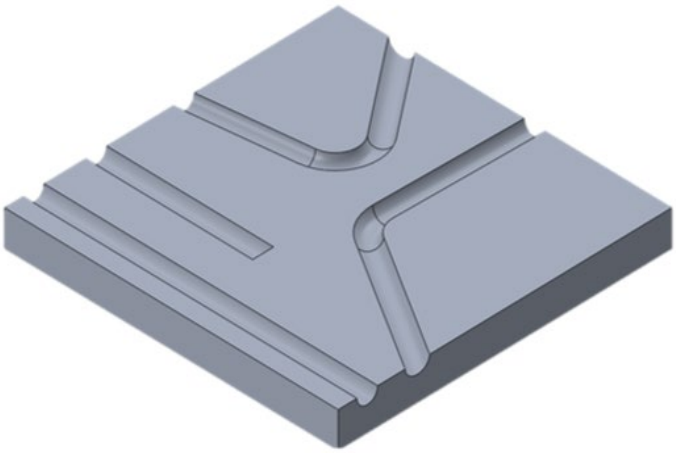
The 'Internal Finishing for AM CRP' has delivered both theoretical and practical information; which will be utilised by cross sector product engineering teams setting out to utilise enhanced surface finishes in AM products.

Cameron Ross, Engineering Director, Meggitt PLC

FUTURE PLANE ONE



FUTURE PLANE TWO



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