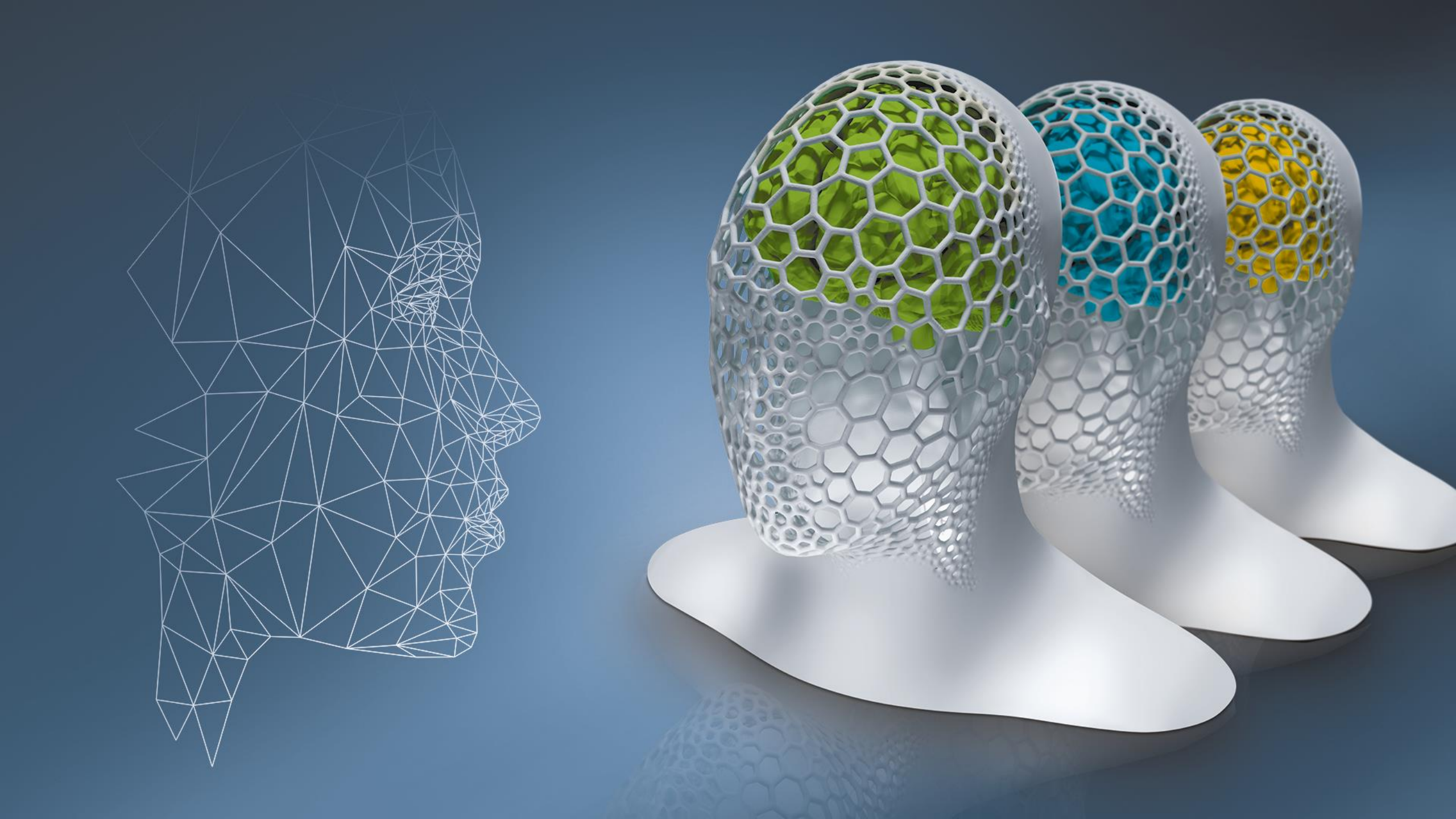

EFFICIENT POST PROCESSING OF COMPONENTS MADE BY ADDITIVE MANUFACTURING

Dr.-Ing. Philipp Imgrund, Fraunhofer IAPT

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AGENDA

1 Motivation

2 Benchmark of Surface Finishing Processes for Metal AM Components

3 Extract of the Results of the Study

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Post-processing for parts made by additive manufacturing

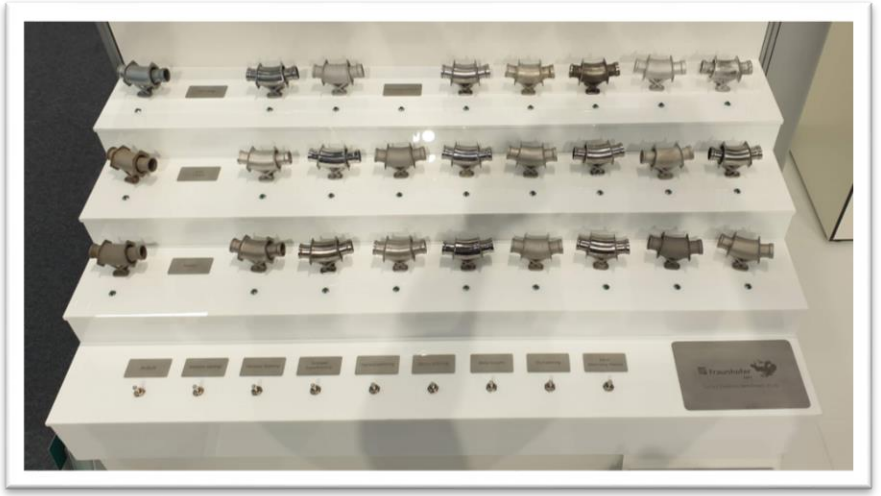
Influence of different post-processing techniques on part properties

- Nearly all components made by AM require finishing operations
- Companies are insecure with regards to correct choice of finishing technology



➡ Independent investigation of surface quality after post-processing of AM parts

- Aluminium AlSi10Mg
- Titanium Ti6Al4V
- Stainless steel 1.4404



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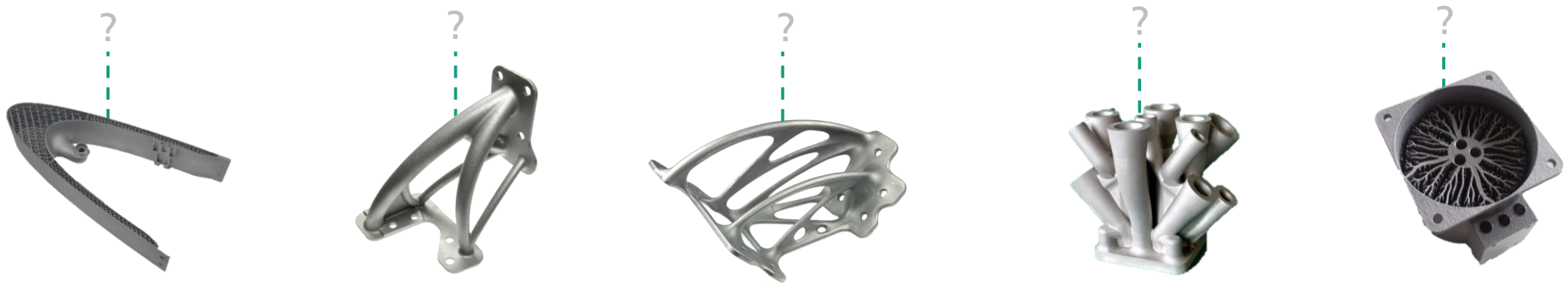
Surface Finishing in Conflict Between Quality and Costs

- What surface properties can be achieved with which post-processing method?
- What are strengths and limitations of the most market relevant post-processing methods?
- How suitable are the post-processing methods for different AM materials?
- What are price ranges of the post-processing methods and their major cost drivers?





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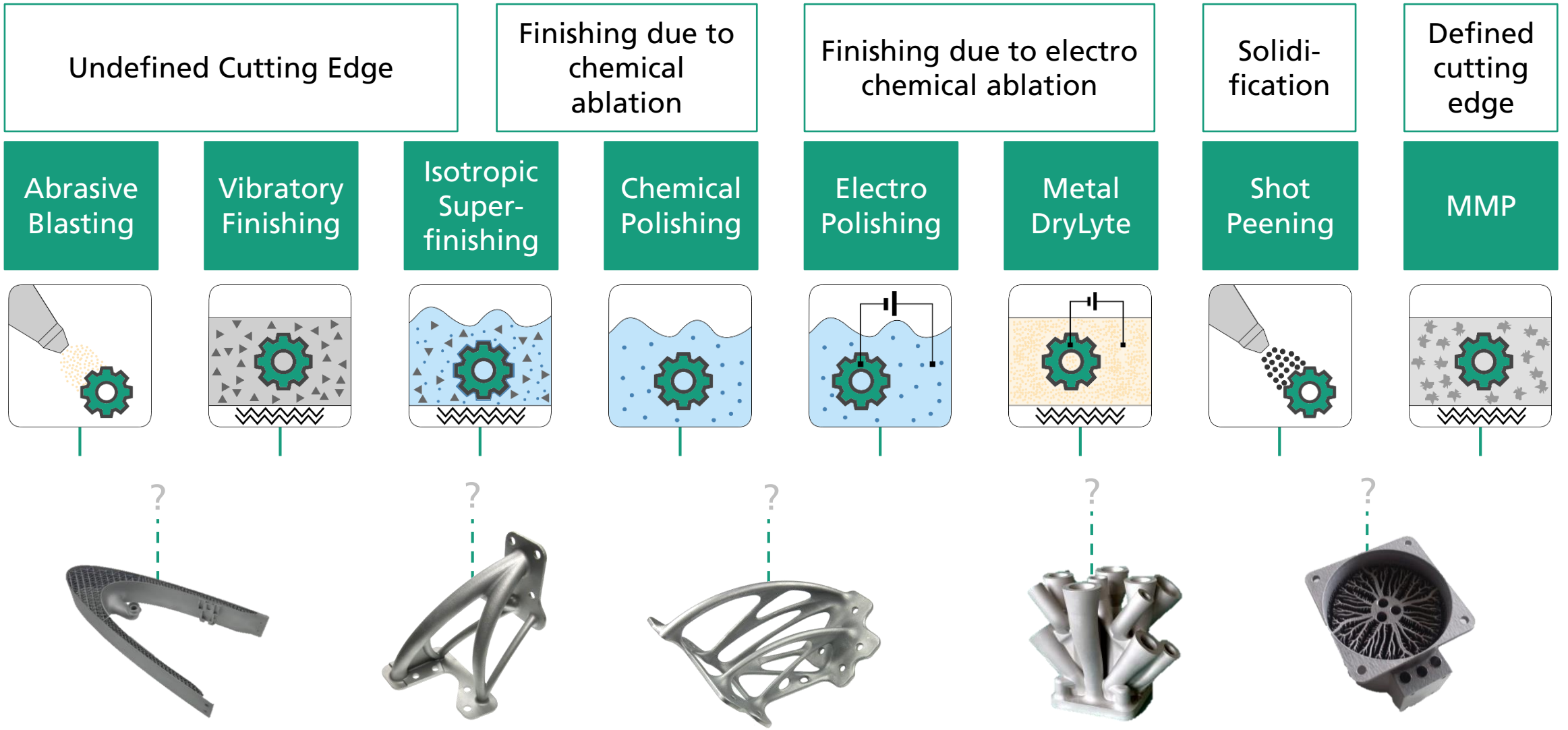
Surface Finishing Methods Investigated



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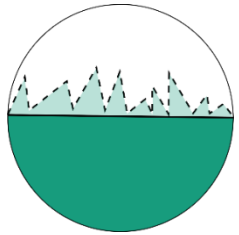
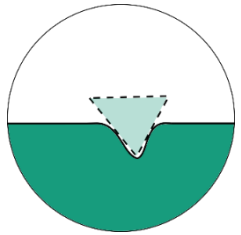
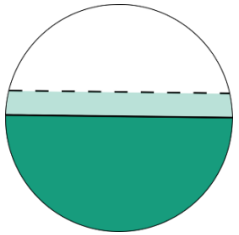
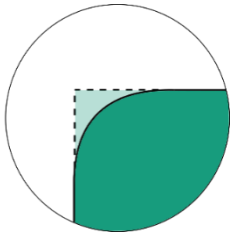
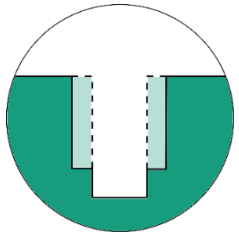
General Considerations


Surface Roughness


Hardness


Erosion Rate


Edge Rounding


Penetration Depth



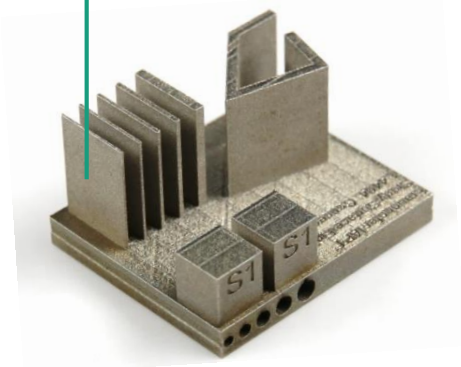
Readability

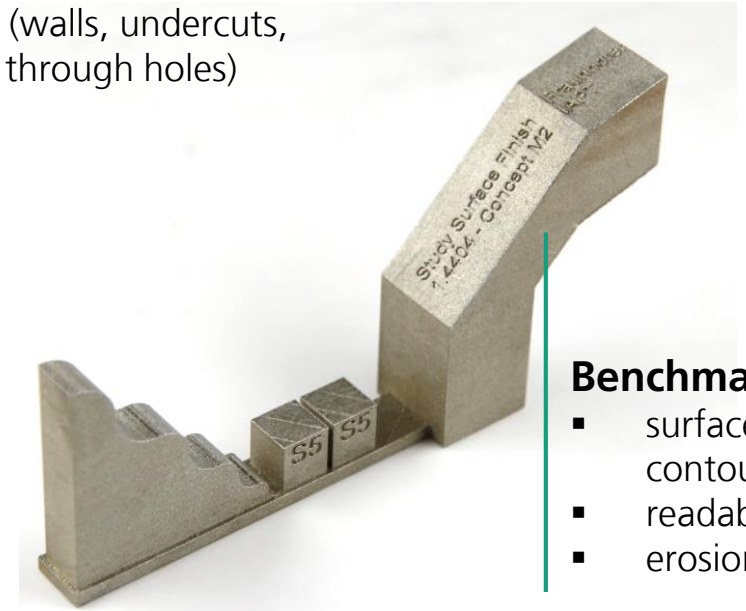


Costs

Benchmark Specimen A

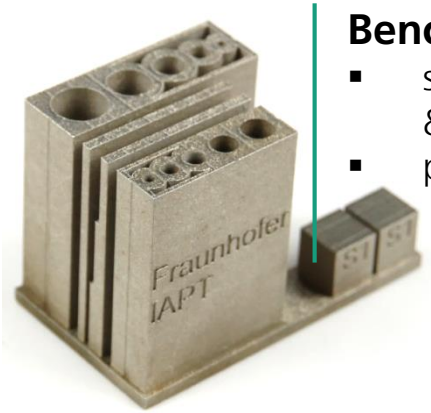
- surface roughness (walls, undercuts, horizontal blind & through holes)
- ablation on walls
- edge roundness
- penetration depth





Benchmark Specimen C

- surface roughness (vertial blind & trough holes, lengthway gap)
- penetration depth



Benchmark Specimen B

- surface roughness (different overhanging angles, side surface, inner/outer contours and supports)
- readability (inner & outer lettering)
- erosion rate (inner & outer radius)

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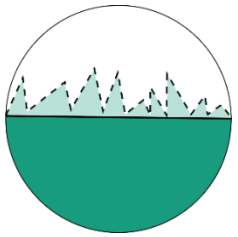
Extract of Benchmark Results
TiAl6V4 - Surface Smoothing



Reference Part



Abrasive Blasting



Vibratory Finishing



Shot Peening



Chemical Polishing



Electro Polishing



Isotropic Superfinishing



MMP



Metal DryLyte



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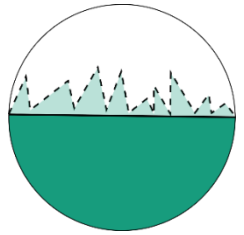
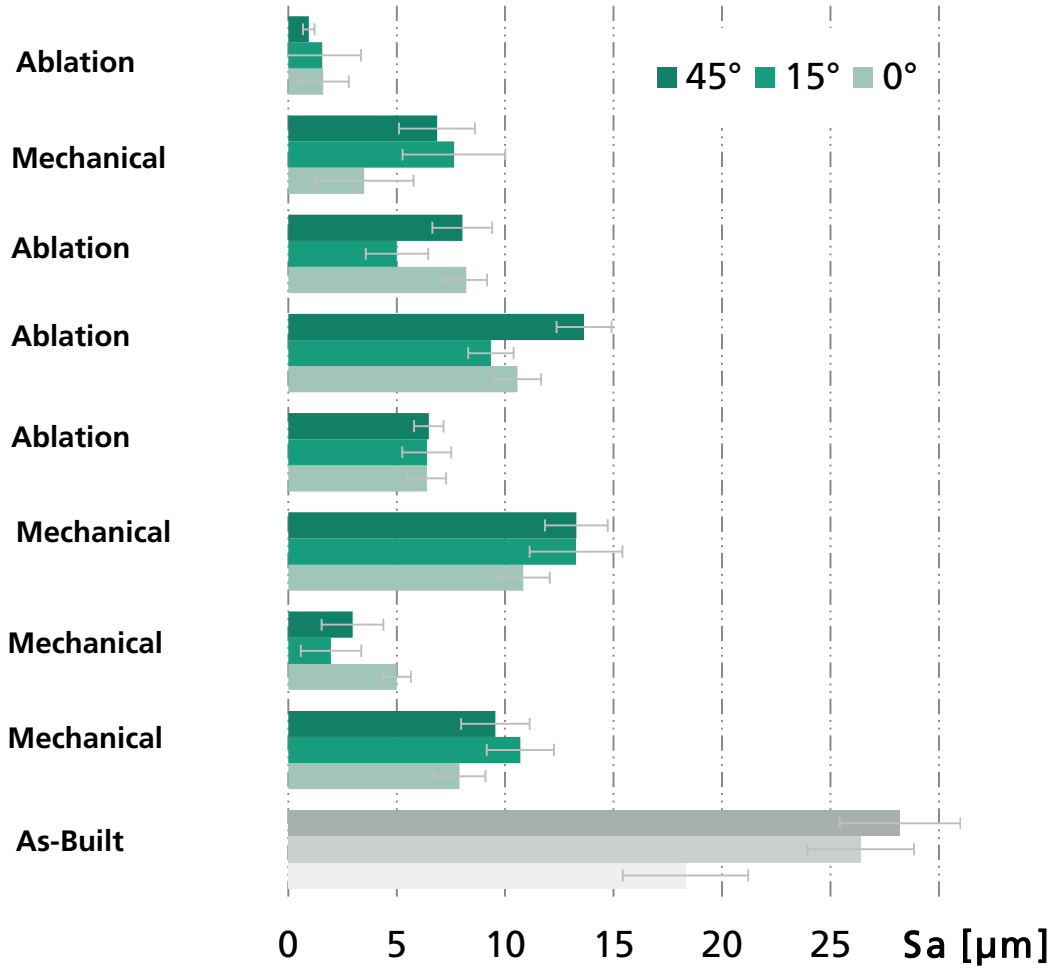
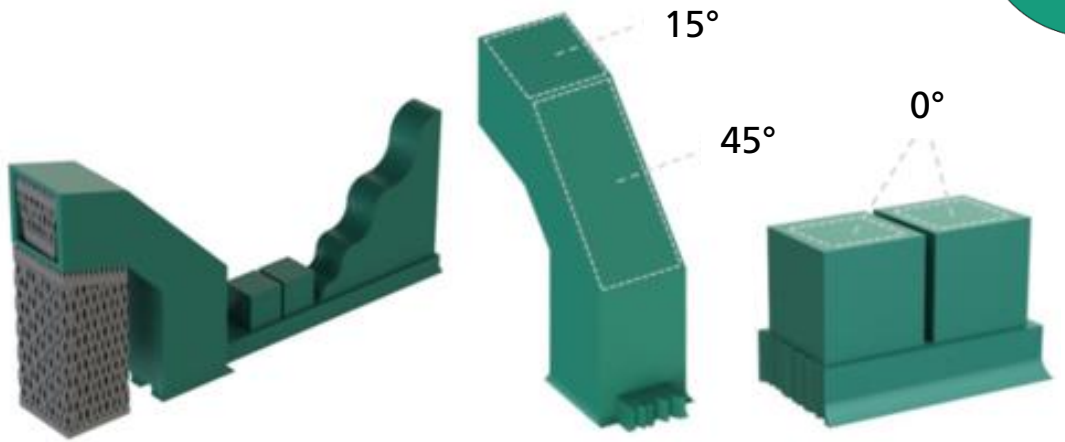
Extract of Benchmark Results
TiAl6V4 - Surface Roughness - *Upper Surface*







- All processes show significant improvement of surface quality
- *One ablation* and one *mechanical process* achieved best surface quality

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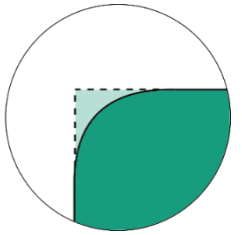
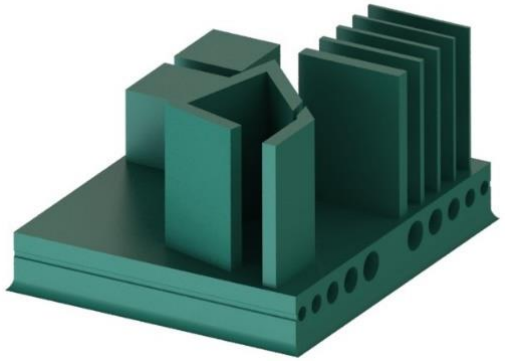
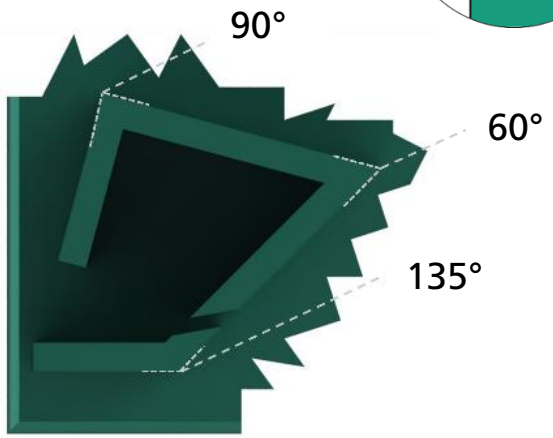
Extract of Benchmark Results
TiAl6V4 - Edge Rounding of Outer Edges







Edge Rounding: Outer Edge			
Angle	60°	90°	135°
Ablation			
Mechanical			
Mechanical			
Ablation			
Ablation			
Mecahnical			
Mechanical			
Mechanical			

Edge-Radius Deviation:

< 50 %
50 - 100 %
> 100 %

- *One mechanical process* shows most significant edge rounding
- good to moderate edge rounding for other processes

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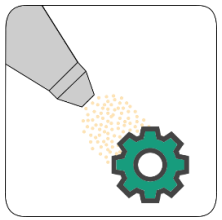
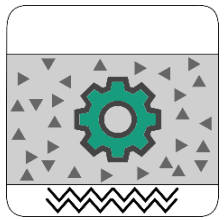
Extract of Benchmark Results
Processes at a Glance - TiAl6V4 Comparison



Process 1



Process 7





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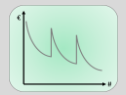
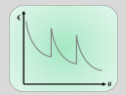
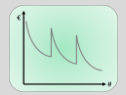
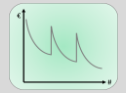
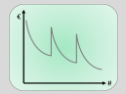
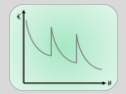
Extract of Benchmark Results
Price Range and Cost Drivers

Price range [€]	< 50	< 100	< 200	< 300	< 400	< 500	< 600	< 700	< 800	< 900	1.000	Scalability	Economy of scale (Cost per part)
Process 1	■	■											
Process 2	■	■	■	■	■								
Process 3	■	■											
Process 4			■	■	■	■	■						
Process 5					■	■							
Process 6								■	■	■			
Process 7							■	■	■				
Process 8				■	■								

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Increase the Efficiency of Your Post-Processing



- **~ 100** test specimens have been printed, post-processed and analyzed
- Summarized in a **120-page** report
- **Order free excerpt of the study with benchmark results at**
  - surface.finshing@iapt.fraunhofer.de
- Follow-up investigations:
  - Additional materials (e.g. Inconel / polymer)
  - Effect on mechanical properties (static & fatigue)

→ please let us know your needs and suggestions

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New study: Influence of Surface Finishing on Mechanical Properties

What do we offer?

- Study about **fatigue and tensile testing** for **two materials** and **up to six surface finishing methods**
- We evaluate and prepare the obtained measurement data
- **Report** as a hard copy and as a pdf-file
- **Presentation & discussion** of key results with all participants



Presentation of results: **Q4 2020**

Hand out of report: **Q4 2020**

Price for the study: **6.500 €**

Reduced price until 28.02.2020: **5.000 €**

Benefits for early birds:

- Possibility to **vote for investigated materials and finishing methods**
- Listing as sponsor or partner in the report
- **Get the early bird discount!**

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