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Investment Casting vs Binder Jet 3D Printing at Wall Colmonoy Limited

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Introduction

Following the introduction of a new manufacturing process known as Binder Jet 3D Printing (BJ3DP) it has forced companies across the world to review their own processes in relation to the manufacturing of customers products using traditional casting techniques.

My employer Wall Colmonoy is no different, and therefore having decided to invest in and provide both manufacturing processes, this study is a study of the key elements and differences between the two, that when analysed, enable the company to decide which best suits the manufacturing process of its customers products.

Project Aims

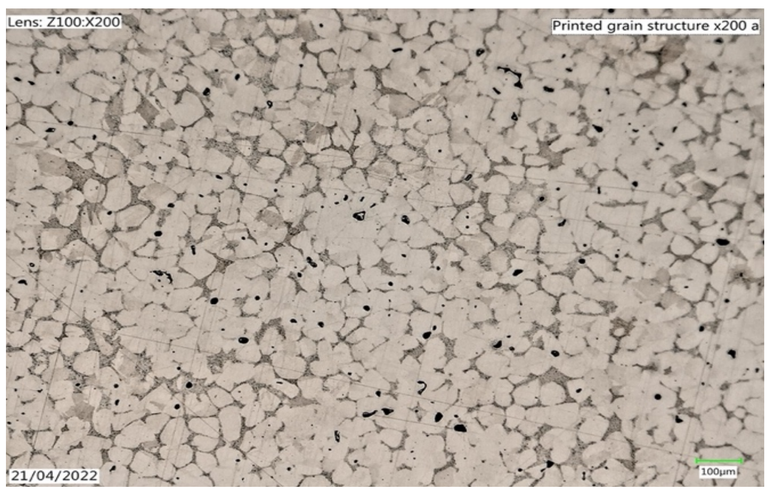
- To compare and contrast Investment Casting and Binder Jet 3D printing.
- To inform the reader of the background of either manufacturing process.
- Allow the reader to make the best decision possible when choosing a production method for their customers parts.

Methodology

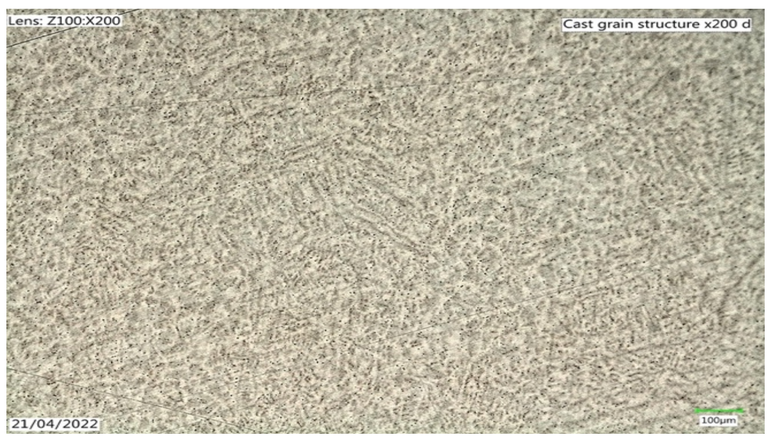
Criteria to compare and contrast the two processes.

- Cost of production
- Process capacity
- Materials available
- Process lead time
- Part geometry
- Key tolerances
- Simulation work required, tooling and fixturing
- Optimal part properties

Results

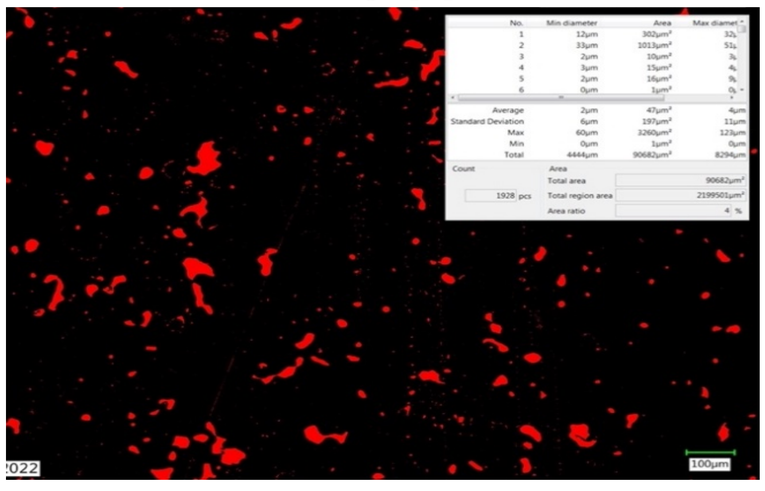


Grain structure of a 3D Printed sample.

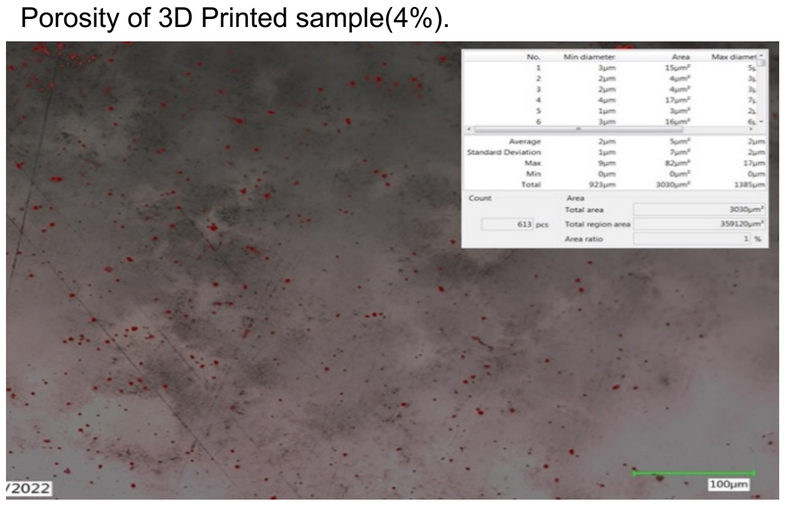


Grain structure of a Cast sample.

On analysis of these samples it was noticed that the 3D Printed sample showed better grain structure characteristics as it had a equiaxed grain structure compared to dendritic structure of the casting. These results aligned with the fact that the tensile strength of 3D printed material was higher than that of Investment casting. [1]



Porosity of 3D Printed sample(4%).



Porosity of Cast Sample (1%).

As can be seen by the analysis done on samples from our sample castings and 3D printed material, the amount of porosity within the cast sample is far better. This is an area where 3D Printing must improve as porosity can lead to failures.

Conclusion

By evaluating both of these manufacturing processes it is apparent that the newer 3D printing process will not completely take over from casting. But there is in fact space for both in the market as castings still has advantages over 3D Printing in criteria such as Material selection, Process capacity and certain part properties such as surface finish and porosity.

Table of surface finish values for 3D Printing to compare to the average castings values of 1.4-1.6RA

Surface finish (RA)				
	1	2	3	Avg
Parallel to layering axis	2.94	2.14	2.34	2.47
Perpendicular to layer axis	4.28	3.02	4.76	4.02

Acknowledgements

I would like to thank everyone who has helped me through the duration of this project. Including my colleagues at Wall Colmonoy and all the lectures at University of Wales Trinity Saint David.

And lastly but not least, to my family who have been extremely supportive and helpful during this time.

References

[1]LorenzoDel Giudice, M. F. V., 2020. Mechanical properties of 3D printed material with binder jet technology and potential applications of additive manufacturing in seismic testing of structures. *Additive Manufacturing* , Volume 36.

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