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# Mechanical Properties of SST316L and Inconel 718 Multi-Material Additively Fabricated by Wire Arc Additive Manufacturing with Heat Treatment

**Shinichiro EJIRI, PMP, Nikkiso Co., Ltd., Japan** shinichiro.ejiri@nikkiso.co.jp

## INTRODUCTION & AIM

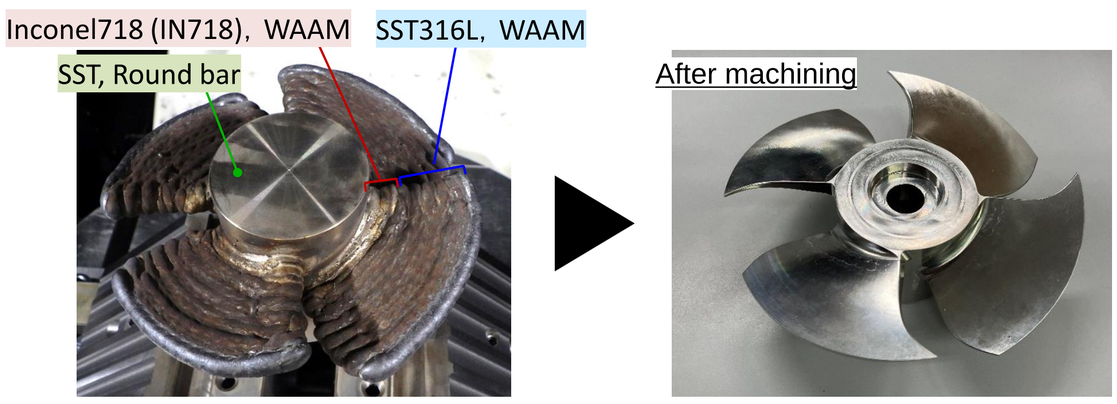
Development of advanced manufacturing technology for turbomachinery, a machine that supports the social infrastructure, is necessary to build an eco-friendly society.

This study focuses on Wire Arc Additive Manufacturing (**WAAM**), which is suitable fabrication of blade components.

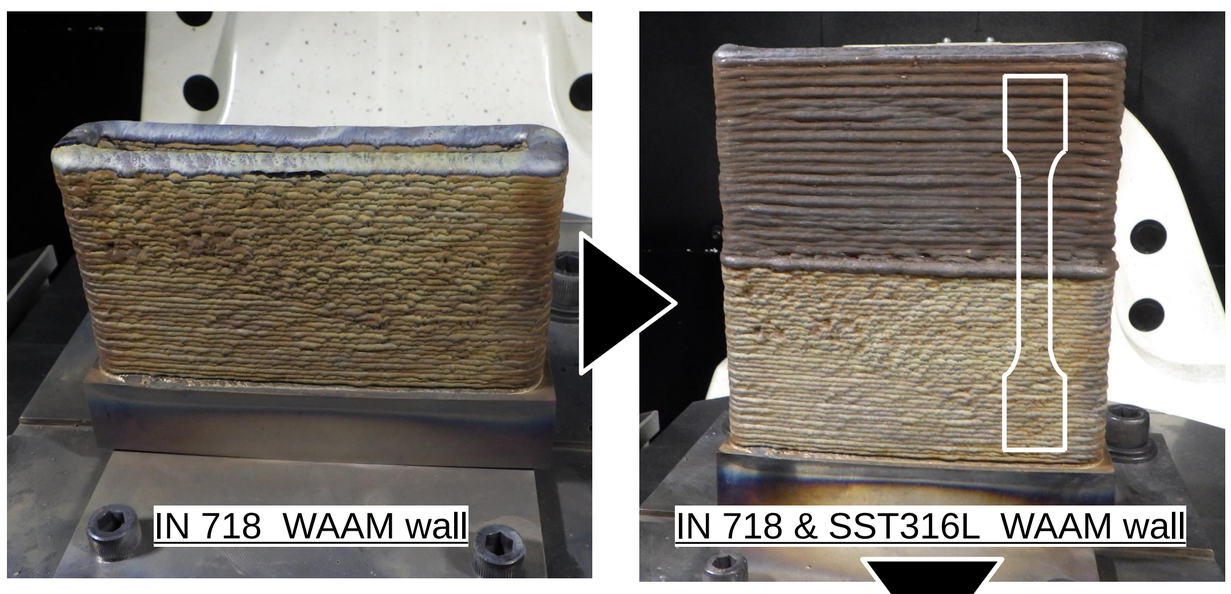
Many studies have been conducted on single materials[1], but studies on multi-materials have been limited and industrial applications have not been fully considered[2].

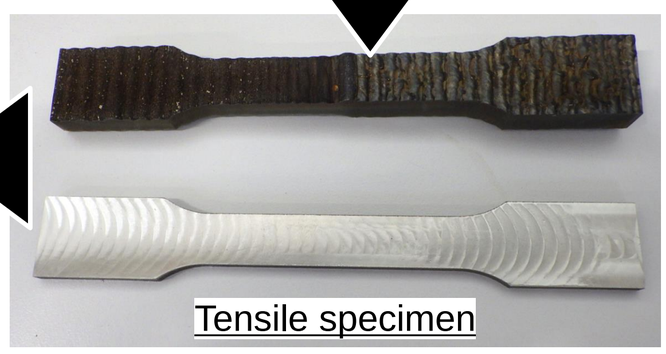
In this study, mechanical properties in consideration of heat treatments of WAAM materials under conditions that enable fabrication of near-net-shape impeller blades are clarified.

Case study: multi-material axial-flow impeller




## METHOD



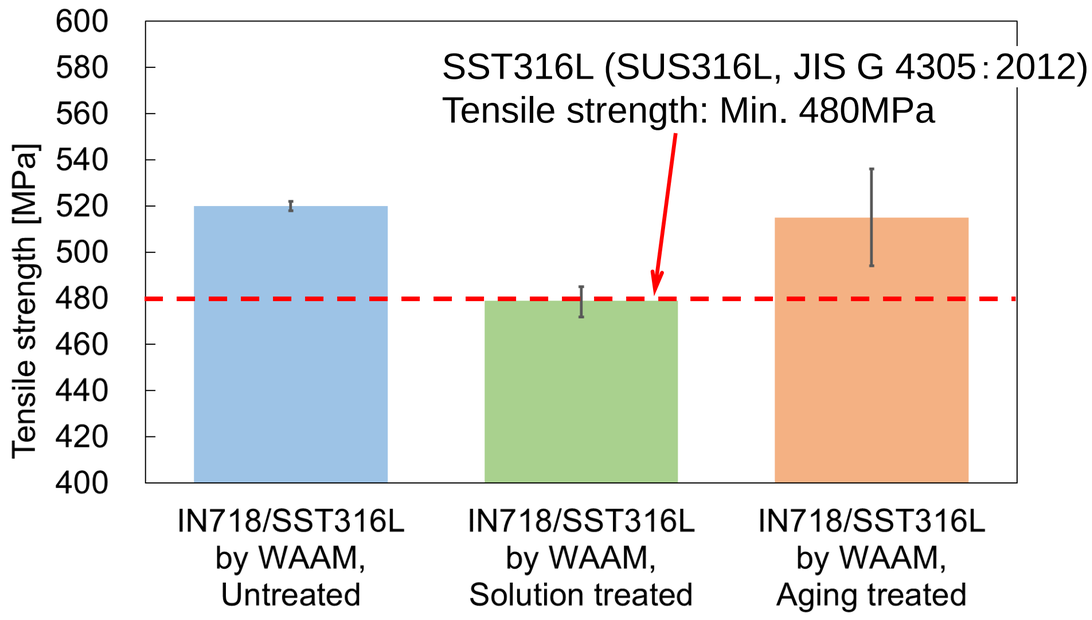

Heat treatment

Tensile Test

1. Untreated
2. Solution treated (ST)
3. Aging treated (STA)

## RESULTS & DISCUSSION

Tensile strength was obtained by conducting tensile tests on several specimens. Comparing the obtained results with the tensile strength of SST316L by JIS standard, the untreated and ageing treated specimens exceeded the minimum value specified in the standard, while the solution treated specimens was slightly below the minimum value specified in the standard. However, the difference from the minimum value in the standard is less than 10 MPa. Therefore, it can be concluded that the multi-material components of IN718 and SST316L fabricated by WAAM have sufficient strength to be used in industry. The specimens were broken from the stainless steel part in the case of untreated and solution treated, and from the dissimilar material joint in the case of ageing treated.




Tensile specimen after breakage

Untreated

Solution treated

Aging treated

## CONCLUSION

Tensile tests were conducted on multi-material components of SST316L and Inconel 718 fabricated by WAAM under different heat treatment conditions. As a result, it was clarified that the tensile strength of the multi-material components fabricated by WAAM was sufficient for industrial use in any of the heat treatment conditions.

## FUTURE WORK

This study was evaluated as an initial test of multi-material materials by WAAM. Further analysis of various materials and additional manufacturing conditions is needed.

[1] B. Wu, et al., *Journal of manufacturing processes*, 2018, 35, pp. 127-139.
[2] S. Ejiri, *Turbomachinery*, **2024**, 52-6, pp. 367-373. (in Japanese)