

Joint Event

9th International Conference on

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Webinar

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Welding of nickel based superalloy for gas turbine engine applications

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Statement of the Problem: Inconel 718 is a nickel-ferrous-chromium based superalloy extensively used in the industrial sector at elevated temperature up to 650^oC owing to its better mechanical properties and weld ability. However, it is amenable to some metallurgical problems during welding such as constitutional segregation and consequential laves phase formation in fusion zone (FZ) which severely deteriorates the service performance of Inconel 718 joints. This alloy also reveals extreme tendency to micro fissuring in heat affected zone (HAZ) owing to the eutectic phases and carbides developed at the grain boundaries. It causes the premature failure of welded aero-engine components. Gas Tungsten Arc Welding (GTAW) process is comprehensively employed for welding of Inconel 718 to produce high-quality joints. However, the high heat input and lower joint penetration associated with wider bell-shaped arc column principally constrains its applications and employability in making the highly efficient joint. The laves phase formation and HAZ micro fissuring can be mitigated by lowering the heat input and increasing the rate of cooling. The electron beam (EBW) and laser beam (LBW) welding have shown significant influence on minimizing the laves phase formation but they are susceptible to porosity related defects and liquation cracking owing to the rapid rate of cooling. This paper provides an overview of the weld ability studies on Inconel 718 alloy. The physical metallurgy of Inconel 718 alloy is explained briefly. The effect of welding processes (GTAW, EBW and LBW) on microstructural characteristics, tensile properties, hardness, hot tensile, stress rupture and hot corrosion of Inconel 718 joints is reported and discussed.

Keywords: Inconel 718, Segregation, Laves phase, Microstructural, Characteristics, Mechanical Properties, Post weld heat treatment.

Recent Publications:

1. Sonar, T., Balasubramanian, V., Malarvizhi, S., Venkateswaran, T., & Sivakumar, D. (2021). An overview on welding of Inconel 718 alloy-Effect of welding processes on microstructural evolution and mechanical properties of joints. *Materials Characterization*, 174, 110997.
2. Sonar, T., Balasubramanian, V., Malarvizhi, S., Venkateswaran, T., & Sivakumar, D. (2021). Maximizing strength and corrosion resistance of InterPulsed TIG welded Superalloy 718 joints by RSM for aerospace applications. *CIRP Journal of Manufacturing Science and Technology*, 35, 474-493.
3. Sonar, T., Balasubramanian, V., Venkateswaran, T., Sivakumar, D., & Konovalov, S. (2022). Effect of Delta Straight and Delta Pulsed Arc Modes on Weld Bead Geometry, Microstructure and Tensile Properties of InterPulsed GTCA-welded Inconel 718 Alloy Joints for Aerospace and Nuclear Applications. *Transactions of the Indian Institute of Metals*, 75(2), 503-512.

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4. Sonar, T., Balasubramanian, V., Malarvizhi, S., Venkateswaran, T., & Sivakumar, D. (2022). Optimization of CA-TIG welding parameters to predict and maximize tensile properties of super alloy 718 sheets for gas turbine applications. Aircraft Engineering and Aerospace Technology.

Biography

Tushar Sonar is working as a Senior Research Scientist in Department of Welding Engineering, Institute of Engineering and Technology, South Ural State University, Chelyabinsk, Russia. He is serving as Academic Editor for the journal "Advances in Materials Science and Engineering (Hindawi Publication-SCIE Indexed; Impact factor: 2.098)" and Associate Editor for "World Journal of Engineering (Emerald Publication-ESCI indexed)". He completed Ph.D. in Manufacturing Engineering (Welding) from Annamalai University, Annamalai Nagar, Tamil Nadu State in the year 2021. He is a recipient of ISRO RESPOND research fellowship and worked in collaboration with Vikram Sarabhai Space Centre (VSSC), ISRO, Thiruvananthapuram, Kerala State for his Ph.D. research work. He completed his M.Tech. (Mechanical Engineering) from Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in the year 2016 and B.E (Mechanical Engineering) from Pune University in the year 2013. He has published 40 research papers in reputed national and international journals and presented 15 research papers in international conferences. He has total of 6 years of work experience including teaching and research. His research interests include Welding and joining, Additive Manufacturing and Heat Treatment of metals.

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