OPEN ACCESS Freely available online

ISSN: 2168-9873
Journal of Applied Mechanical Engineering

Perspective

Heat Transfer and Mass Flow Process Involved in Welding

Matthew Eersias*

Department of Geotechnical Engineering, University of Kentucky, Lexington, Kentucky, USA

DESCRIPTION

The understanding of heat transfer and mass flow in welding is very important in the production of welds. The basic understanding of the heat transfer study is to understand the temperature distributions. The measurement of the temperature distributions on the surface of the weld pool and in the weldment provides important information on heat and mass transfer characteristic such as peak temperature attained, shape of the weld, cooling rate, velocity field etc. However the measurement of the temperature at the surface and the molten weld pool during welding is difficult, although some techniques developed are much complex, requires specialized equipments and are highly expensive. Therefore, quantitative calculations are made to gain insight into phenomenon of heat transfer and mass flow in welding.

Traditional calculations are made through the analytical solutions of the heat conduction equations to obtain the thermal cycles and other parameters. Analytical studies in welding are limited to conduction calculations due to complexity of the convection calculations. In recent decades due to the availability of the high speed computers these complex convections calculations made easy by computational numerical simulations. These numerical calculations consider both conduction and conduction equations along with the thermo mechanical properties and change of phases. Also these rigorous heat flow calculations are also help in quantitative calculations of the structure, composition and weld geometry. This type of approach in recent generation is termed as computational methods where the Finite element analysis is made using suitable FEA software.

In order to have a systematic computational approach experimental validations are very important need for the verification of the simulation results and developing the errors between the experimental work and the computational work carried. The fields of computational heat transfer and field flow and computational thermo mechanical study are progressively developing with the high quality modelling and analysis software. The recent research focuses on the Thermal and Mechanical behavior during the various manufacturing techniques like Welding, Casting, metal forming etc., which involves Heat transfer and fluid flow behaviors of metals and some mechanical defects like cracks, distortions, residual stresses etc. Presently, several research communities in India and many other countries are working with different aspects of computational manufacturing techniques.

The welding process involves both thermal and mechanical behavior. In order to obtain and ensure a good weld quality thermal Energy input in the form of heat is very important parameter. The heat input should be controlled to have at best and consistent welded joint. There are many ways to evaluate the heat input in welding and the common method of calculating the welding heat input is by using welding current.

CONCLUSION

The European standard for heat input calculations differs from the American system. It uses a correction factor called thermal efficiency or arc efficiency which considers the heat losses incurred during welding. Thermal Analysis in welding is made on the basis of fundamental law of conservation of energy and law of conservation of mass principles. Therefore, the study of Heat transfer behavior and mass flow or fluid flow in different welding processes, more attention is made on energy and mass ignoring mechanical behaviors like displacement, stress and strain. The heat transfer behavior take a very vital role in welding analysis and the metal flow study is not much predominant as the metal flow is very faster during melting and solidification during welding.

Correspondence to: Matthew Eersias, Department of Geotechnical Engineering, University of Kentucky, Lexington, Kentucky, USA, E-mail: eersias.m@carl.edu

Received: 01-Nov-2022, Manuscript No.JAME-22-19317; **Editor assigned:** 04-Nov-2022, Pre QC No. JAME-22-19317 (PQ); **Reviewed:** 18-Nov-2022, QC No JAME-22-19317; **Revised:** 25-Nov-2022, Manuscript No. JAME-22-19317 (R); **Published:** 05-Dec-2022, DOI: 10.35248/2168-9873.22.11.446.

Citation: Eersias M (2022) Heat Transfer and Mass Flow Process Involved in Welding. J Appl Mech Eng. 11:446.