International Journal of Modern Manufacturing Technologies
ISSN 2067–3604, Vol. XIII, No. 1 / 2021

# COMPARATIVE ANALYSIS AND INVESTIGATIONS OF WELDING PROCESSES APPLIED FOR HARDFACING USING AHP

**Sachin Kakade, Ajaykumar Thakur**

Sanjivani College of Engineering, Department of Mechanical Engineering
Kopargaon, Maharashtra - 423603, India

Corresponding author: Sachin Kakade, sachinkakade2107@gmail.com

***Abstract:*** Hardfacing by welding techniques has been proving to be decisive in many industries like chemical, fertilizer, nuclear, power, etc. for improving the tribological characteristics of substrate material. These industries continuously try to improve the base material surface characteristics by deposition of superficial layers using suitable hardfacing techniques. The selection of suitable and efficient hardfacing technique plays an important role in the characteristics of the coated surface. For the same purposes, improvement in surface properties and the quality of the hardfaced layer are the main selection criteria of the welding techniques. Selecting the suitable hardfacing technique is a complex task and can be solved through hierarchical analysis. Hence, considering huge applications of this process in the industrial domain, this paper aims to present a systematic approach for selection of best suitable welding technique for hardfacing to achieve the desired quality of hardfaced surface. Five different welding techniques including shielded metal arc welding, metal inert gas, tungsten inert gas-manual, tungsten inert gas -automatic, and plasma transferred arc welding are considered for the analysis and investigations. The plasma transferred arc welding is the most suitable technique for hardfacing based on qualitative and quantitative parameters considered in this investigation.

***Key words:*** AHP, hardfacing, PTAW, TIG, MIG, SMAW

## 1. INTRODUCTION

Most of the components exposed to the critical environment required superior corrosion and wear resistance for better service life (Balasubramanian et al., 2008). Hence, hardfacing techniques are being extensively used to modify surface properties of key elements by depositing relatively hard material using suitable welding techniques (Ramachandran et al., 2009). In recent years hardfacing by welding techniques are technologically advanced and have been applied in various industries such as chemical, fertilizer, nuclear, power, agriculture, etc. (Balasubramanian et al., 2008, Deshmukh and Kalyankar,2018, Deshmukh and Kalyankar, 2019 b). Several industries are applying hardfacing technology due to its beneficial effects in improvement of service life of components with wear and corrosion resistance. The selection and controlling of welding process parameters with the welding technique according to its operating principles and capabilities playing an important role in aggregating and marinating the characteristics of the coating for long periods of time in aggressive environments. The process of hardfacing required special attention as it is cumulatively based on processing conditions. Hence, these processes are becoming a key attraction in industry. Hardfacing welding techniques like tungsten inert gas (TIG) (automatic and manual) welding, shielded metal arc welding (SMAW), oxyacetylene gas welding (OAW), metal inert gas (MIG), plasma transferred arc welding (PTAW) have been extensively useful in the industries to improve surface and tribological properties of substrate material (Deshmukh and Kalyankar, 2019a). It is distinguished in industries that many components are failed during working or even in the stage of fabrication due to the application of improper hardfacing welding technique.

The identified reasons of failure include fatigue, lack of bonding between the substrate and hardfaced layer (delamination), dilution (affect metallurgical and mechanical properties), defects in hardfacing like cracks, blow-holes, porosity (Balamurugan and Murugan, 2014). Such types of failure in components can be avoided by incorporating suitable hardfacing techniques. The quality of hardfacing depends on the deposition technique as well as alloys (materials) used. Therefore, the selection of techniques for hardfacing to achieve the desired characteristics and superiority (defect-free surface) of the surface is essential before undertaking the fabrication task (Ravisankar et al., 2006). The hardfacing processes can be classified based on metal deposition techniques and weld hardfacing (Deshmukh and Kalyankar, 2019a). The past research highlighted in the area includes Jayant and Singh (2015) who investigated the best suitable welding process for high-pressure vessel manufacturing using twelve