Chapter 5

Summary and Conclusions

Chapter 5 summarizes the results obtained for achieving the objectives of the present investigation are drawn as important conclusions from various experimental investigations conducted. This chapter also briefs the possible future scope of the present investigations.

5.1 Summary and Conclusions

Metal Inert Gas Welding (MIG) are the most extensive gas shielded arc welding processes used in the joining of A6061 and A6063 aluminium alloy due to their preferable flexibility and economy. MIG welding is high-quality and stable welding processes which have low weld spatter and good weld bead appearance characteristics. But there are few problems like low welding speed, porosity, partial penetration and lack of the deposited metal that occurred during this process. Shielding gases are an essential element in the operation of fusion welding. There are several gases commonly used each with its specific properties like ionization potential, which creates unique arc characteristics.

Hence, the present investigation was carried out to study the effect of heat input and optimize the joint properties. Comparison with the conventional method of MIG welding with A6061 and A6063 aluminium alloy. The three sets combination was used such as current, voltage and gas flow rate. Influence of current, voltage and gas flow rate. On the bead profile characteristics like depth and area of penetration were studied. Bead-on-plate welding was performed on a 5mm thickness A6061and A6063 aluminium alloy at different combinations of input parameters like welding current, welding voltage and gas flow rate. From the experimental results, working ranges of process parameters. Current, voltage and gas flow rate were identified. To predict bead penetration depth and bead penetration area of MIG welded beads of A6061 and A6063 aluminium alloy. Further to investigate the influence of current, voltage and gas flow rate. On mechanical and metallurgical properties of welded joints of A6061 and A6063 aluminium alloy, joints were fabricated using MIG welding processes by current, voltage and gas flow rate were identified. To enhance the mechanical properties of MIG welded joints. The

mechanical properties such as ultimate tensile strength, hardness were evaluated for the MIG welded joints. In addition, the micrographs, fractography and elemental distribution were analyzed using optical microscopy, scanning electron microscopy and XRD respectively. The influence of heat input and the mechanical and metallurgical properties were discussed. The conclusions obtained from the above studies are presented in this chapter. A6061 and A6063 aluminium were successfully butt welded by MIG welding, leading to an increase in weld tensile strength. Modifying welding process parameters can help to control heat input and optimize the joint properties. The nature of dispersed precipitates can be improved by controlling the parameters i.e. current, voltage and gas flow rate. Moreover, the grain size of the fusion zone was remarkably decreased by controlling these parameters due to the rapid solidification mechanism. Improvements in microstructural homogeneity in the fusion zone resulted in a continuous increase in microhardness and tensile strength of MIG welded A6061 and A6063 aluminium alloy. The achieved Yield Strength (YS) and Ultimate Tensile Strength (UTS) was 152 MPa and 220 MPa at 160 amp, 18 volts and 14 LPM has the highest value among all the selected parameters for A6061 aluminium alloy. The achieved Yield Strength (YS) and Ultimate Tensile Strength (UTS) was 90 MPa and 160 MPa at 160 amp, 18 volts and 14 LPM has the highest value among all the selected parameters for A6063 aluminium alloy. The optimized process parameters of MIG welding can be used to attain better bead profile characteristics in A6061 and A6063 aluminium alloy beads. The optimized values obtained from experimentation and response surface methodology which gives a good agreement.

5.2 Suggestions for Future Work

Though the present investigation has brought out some important results and conclusions on MIG welding of A6061and A6063 aluminium alloy using current (I), welding voltage (v) and gas flow rate (lb). The research work can be extended further to address the following issues.

- As A6061 and A6063 aluminium alloys are heat treatable, hence the effect of dispersed precipitate in the fusion zone can be improved by adopting the heat-treatment process.
- Effect of the backing plate on the grain size of heat-affected zone (HAZ) and fusion zone (FZ) will be investigated.
- To improve the weld strength average heat input can be controlled by using pulse Metal Inert Gas (MIG) welding. Cold metal transfer welding process can be used to joining of aluminium alloy to avoid formation of undesired intermetallic.
- Influence of alternating shielding gases on welding voltage waveforms are to be investigated by conducting signature analysis.
- Effect of heat input on bead and joint characteristics can be investigated using alternating shielding gases.
- Empirical relationships developed in this investigation are to be modified by incorporating other process parameter such as filler feed rate, arc length etc.
- Appropriate properties like creep, corrosion and fatigue behaviour of welded specimens may be evaluated.