CHAPTER - 1

INTRODUCTION

1.1 INTRODUCTION

In manufacturing industries, manufactures focused on the quality and productivity of the product. Due to the increasing demand for quality products, manufacturing engineers are faced with the problems for increasing productivity without compromising quality [1].

Today majority of products are manufactured by assembly and joining standard rolled parts using welding process to make near net shape. In this variety of similar and dissimilar metal pieces are joined. Welding is a localized heating and cooling process. There are wide varieties of welding process are available, appropriate process is selected for the applications [2-5]. Welded structure should give good quality hence the life of product will be more. The quality of the welded structure mainly relies on the weld procedures. An appropriate good procedure is essential in arc welding.

Welding is widely used by Metal workers in the fabrication, Maintenance, and Repair of parts and structures. While there are many methods for joining metals, welding is one of the most convenient and rapid methods available. The term welding refers to the process of joining metals by heating them to their melting temperature and causing the molten metal to flow together. These range from simple steel brackets to nuclear reactors. Welding, like any skilled trade, is broad in scope and you cannot become a welder simply by reading a book. You need practice and experience as well as patience; however, much can be gained through study [6-7]. For instance, by learning the correct method or procedure for accomplishing a job from a book, you may eliminate many mistakes that otherwise would occur through trial and error.

The use of welding is still increasing, primarily because it is the most economical and efficient way to join metals. If a joint is welded, it is a permanent joint. Obviously, if the joint must be disassembled occasionally it should not be welded. Thus statement changes to “welding is the most economical method to permanently joint metal parts”. To join two members by bolting or riveting requires holes in the parts to accommodate the bolts or rivets. These holes reduce the cross-sectional area of the members to be joined by up to 10%. The joint may also require the use of one or two gusset plates as well as the bolts or rivets thus increasing the amount or weight of material required and the cost. This expense can be eliminated by the use of
a weld. Welding is an important manufacturing process taking its place with other metal working operations to help bring us quality metal products at economical prices [8].

1.2 IMPORTANCE OF WELD QUALITY

When welding was started it was only carried out by blacksmiths to make ornaments by carrying out such melting and joining processes. Today it has gone through complete evolutions with machines playing a major role in every part of life. As the science continues to advance the major changes taking place in the development of welding technology. In order to meet such requirement in depth understanding of the weld qualities and procedures is very much needed as it poses many risk factors and dangers.

There is a tremendous importance of welding in engineering, there are even such things as welding engineers. Welding is what holds the majority of structures together bridges, cars, tractors, cranes, buildings, etc. If any engineer does not have a good understand of this very popular joining process major problems can exist, such as failures from designing a joint that is un-weldable. Most companies these days are trying to hire welding engineers to help with these problems. Welding can get very specialized with more technical metals and applications.

1.3 IMPORTANCE OF WELDING

The importance of this welding is it become possible to weld from low carbon steel to high carbon steel. Gas Metal Arc Welding is a slow process thus the demand for high rate production led to the development of gas metal arc welding in consumable filler wire of small diameter and composition compactable with work materials [9-11].

The most observation of this process is all position welding capability; absence of fluxes, suitable for both ferrous and non-ferrous metals; cleanliness and ease of mechanization are the main attractive features of gas metal arc welding [12-13].

1.4 APPLICATIONS OF WELDING

Welding finds its applications in automobile industry, and in the construction of buildings, bridges, ships, submarines, pressure vessels, offshore structures, storage tanks, oil, gas and water pipelines, girders, press frames, and water turbines. In making extensions to the hospital buildings, where construction noise is required to be minimum, the value of welding is
significant. Rapid progress in exploring the space has been made possible by new methods of welding and knowledge of metallurgy. The aircraft industry cannot meet the enormous demands for aero planes, fighter and guided planes, space crafts, rockets and missiles without welding. The process is used in critical applications like the fabrication of fission chambers of nuclear power plants. A large contribution, the welding has made to the society, is the manufacture of household products like refrigerators, kitchen cabinets, dishwaters and other similar items. It finds applications in the fabrication and repair of farm, mining and oil machinery machine tools, jigs and fixtures, boilers, furnaces, railway coaches and wagons, anchor chains, earth moving machinery, ships, submarines, under water construction and repair.

1.5 DEFINITION OF SIMILAR AND DISSIMILAR METALS

Similar metals are defined as metals having same alloy systems with similar mechanical and chemical properties.

Dissimilar metals are defined as metals having different alloy system with variation in mechanical and chemical properties.

1.6 FOCUSED ON THIS THESIS

In the present work low carbon steel are joined with medium and high carbon steel to meet industrial requirements. In this connection to selected the low carbon steel, medium and high carbon steel metals. Steel is such an important material because of its tremendous flexibility in fabrication processes and metal working. During the production of steel, several elements are added to impart special properties and avoid cold cracking. Some methods are used to improve the mechanical and metallurgical properties of steels [14-15].

In the present work, MIG (Metal Inert Gas) Welding or Gas Metal Arc Welding (GMAW) where as Copper Coated Mild Steel is usually used, that corresponding to voltage, current and welding speed parameters are used to make similar and dissimilar joints [16-17]. Then welding is done for 5 passes with respect is considered. During the welding process some disturbance within the weldment, so that mechanical properties are in attractive manner [18]. Before going for nondestructive testing, the weldment is visually inspected to find surface as well as surface defects and some non-destructive tastings are used find the sub surface defects. A welding defect is any flaw that compromises the usefulness of a joint. When a flaw or flaws
that by nature or accumulated effect render a part or product unable to meet minimum applicable acceptance standards or specifications. The term designates rejectability [19-21]. After the completion of similar and dissimilar weldments, consider a Post weld heat treatment process are annealing, normalizing and tempering are taken to improve the mechanical properties like tensile strength, impact strength and hardness [22-23]. The micro structural properties like grain size and volume fraction analysis are found with help of optical microscope.

The thesis is organized into six chapters.

In the first chapter is a general introduction, importance of welding, welding applications, similar and dissimilar weldments and the focused on the thesis are also presented.

A review of literature is presented in the second chapter. It includes introduction, different processes parameters of welding, different post weld heat treatment processes for improving their mechanical properties of the materials and its effects and comments on the literature review are presented.

In the third chapter involves experimental procedure followed to produce weldments, testing procedures adopted and heat treatment cycles followed. Weld heat input parameters like current; voltage and welding speed used to produce similar and dissimilar joints are selected. Nondestructive testing methods viz. X-ray and diepenetrant tests are discussed. Tensile, Impact and hardness testing procedure of the weldments is explained. Post weld heat treatment methods followed viz. annealing, normalizing and tempering are discussed. Procedure for carrying out microstructure study is also discussed.

In this fourth chapter describes in detail, experimental methods and procedures that were employed to evaluate mechanical and micro structural properties of various versions of similar metal welded joints. The mechanical and metallurgical properties of weldments are improved with different PWHT processes. The weld samples are considered for similar joints with different heat input conditions.

Fifth chapter deals mechanical and metallurgical properties of dissimilar weldments are improved by considering different PWHT processes. The weld samples are considered for dissimilar joints with different heat input conditions and validated present experimental results and previous results. In the sixth chapter sets forth the conclusions and the important findings of this investigation. The scope for future research direction is also presented.