

COURSE: METAL CASTING

Module No. 1: INTRODUCTION

Lecture No-1

Scope, Challenges, Focus and History of Casting Process

Introduction

The metal casting industry plays a key role in all the major sectors of our economy. There are castings in locomotives, cars, trucks, aircraft, factories, and everywhere. Metal casting is one of the oldest manufacturing methods. In metal casting, metal is melted and poured into a cavity and after solidification of the metal in the cavity, the metal takes the exact shape of the cavity. The solidified object is then taken out from the cavity either by breaking the cavity or taking the cavity apart. The solidified object is called the casting. The cavity is also known as mould. The shape and size of the mould matches with the product requirement. However, depending upon the shape complexity and the metal the size of the mould may differ with the size of the product requirement. The mould into which the molten metal is poured is made of heat resistant material. Sand, being the heat resistant, is the most often used material for making the mould. However, permanent mould made of metal can also be used to cast various products. This process allows to produce the complex parts in one go.

Advantages

The metal casting process is extensively used in manufacturing because of its many advantages.

1. Very thin sections, because of the flowability of the liquid metal, can be cast by the metal casting process, which otherwise are difficult to produced by other shaping processes.
2. Intricate and complex shapes can be made by this process.
3. Any material that is ferrous or non-ferrous can be cast.
4. The tooling required for casting molds are very simple and inexpensive. As a result, for production of a small lot, it is the ideal process.
5. There are certain parts made from metals and alloys that can only be processed this way.
6. Size and weight of the product is not a limitation for the casting process.

7. Metal casting is a process highly adaptable to the requirements of mass production.

Limitations

1. Dimensional accuracy and surface finish of the castings made by casting processes are a limitation to this technique. Many new casting processes have been developed which can take into consideration the aspects of dimensional accuracy and surface finish. Some of these processes are die casting process, investment casting process, vacuum-sealed molding process, and shell molding process.
2. The metal casting process is a labor intensive process

Scope of Metal Casting Industry

Metal casting process is the oldest manufacturing process. metal cast products find their application in most of the application product and almost all automobile product use cast product (s) as its component. It can be said that Foundry industry is the mother of all industries. In India, There are around 5100 foundries both large as well small units registered in India. Of these, around 3000 units are grey iron foundries, producing about 5.1 million tons of grey iron casting. About 300 foundries are in the large sector. Out of total units, 80 percent are small units, 15 percent are medium- size and only 5 percent are in large sector. In India the scope of metal casting industry is increasing as the government has made tremendous efforts to improve infrastructure including power generation. The efforts will help metal casting industries, which are power extensive industries, to grow.

The knowledge and application of technology in the area of metal casting will help the industries to excel in all of its application areas. The scope of metal casting industry has widen up. It is now-a-days not limited to metal products, but the application of cast product also include, plastic products, composite, civil and building infrastructure development, bridge construction etc. The new initiatives and additional scope of foundry industry will require the skilled manpower in this field. This will enhance the metal casting industry jobs to huge number of metal casting professionals.

The Present Challenges to Indian Metal Casting Industries

- The high cost of technology and related modern equipment
- The cost of energy, which is increasing every time
- High rate of interest on loans
- Industry and Taxation law policies has become a barrier in the growth and export business
- Irregular supply of raw material
- Environment Pollution

The Focus of Metal Casting Industries must be on

- quality not on the quantity with a spirit of producing right first time and every time
- waste reduction and on improving the productivity
- defect prevention not on defect rectification
- competition on pricing as well
- reduction in lead time. there should not be any tolerance on defects or defectives or delays

History

The history of metal casting reaches back almost 5,000 years BC. A brief development of metal casting technology is given below:

3200 B.C. A frog made from copper metal, the oldest known casting in existence, was cast in Mesopotamia.

233 B.C. Cast iron plowshares are poured in China.

500 A.D. Cast crucible steel was first produced in India

1455 The cast iron pipe to transport the water was used in Dillenburg Castle in Germany.

1480 The Vannoccio Biringuccio "father of the foundry industry," in Italy is the first man to document the foundry process.

1709 The first foundry flask for sand and loam molding was created by Englishman Abraham Darby.

1809 A. G. Eckhardt of Soho, England developed the Centrifugal casting process.

1896 American Foundrymen's Association (Now American Foundrymen's Society) was formed.

1897 B.F. Philbrook of Iowa rediscovered the Investment casting process. Though the roots of investment casting process can be traced when bronze dancing girl found at Mohen-jo-daro around 3000 BC .

1947 The Shell process was invented by J. Croning of Germany during WWII.

1958 H.F. Shroyer was granted a patent for the full mold process.

1968 The Coldbox process was introduced by L. Toriello and J. Robins for high production core making.

1971 The Japanese developed V-Process molding. This method uses unbounded sand and the sand was bind by vacuum.

1971 Rheocasting was developed at Massachusetts Institute of Technology.

Metal Casting History (India)

3000 BC Earliest castings include the 11 cm high bronze dancing girl found at Mohen-jo-daro.

2000 BC Iron pillars, arrows, hooks, nails, bowls and daggers or were found in Delhi, Roopar, Nashik and other places.

500 BC Large scale state-owned mints and processes of metal extraction and alloying have been mentioned in Kautilya's *Arthashastra*

500 A.D. Cast crucible steel was first produced in India.