

Lecture 1

Metal Casting

Introduction

Virtually nothing moves, turns, rolls, or flies without the benefit of cast metal products. The metal casting industry plays a key role in all the major sectors of our economy. There are castings in locomotives, cars trucks, aircraft, office buildings, factories, schools, and homes. (Figure 0) some metal cast parts. Metal Casting is one of the oldest materials shaping methods known. Casting means pouring molten metal into a mold with a cavity of the shape to be made, and allowing it to solidify. When solidified, the desired metal object is taken out from the mold either by breaking the mold or taking the mold apart. The solidified object is called the casting. By this process, intricate parts can be given strength and rigidity frequently not obtainable by any other manufacturing process. The mold, into which the metal is poured, is made of some heat resisting material. Sand is most often used as it resists the high temperature of the molten metal. Permanent molds of metal can also be used to cast products.

Figure 0 : Metal Cast parts

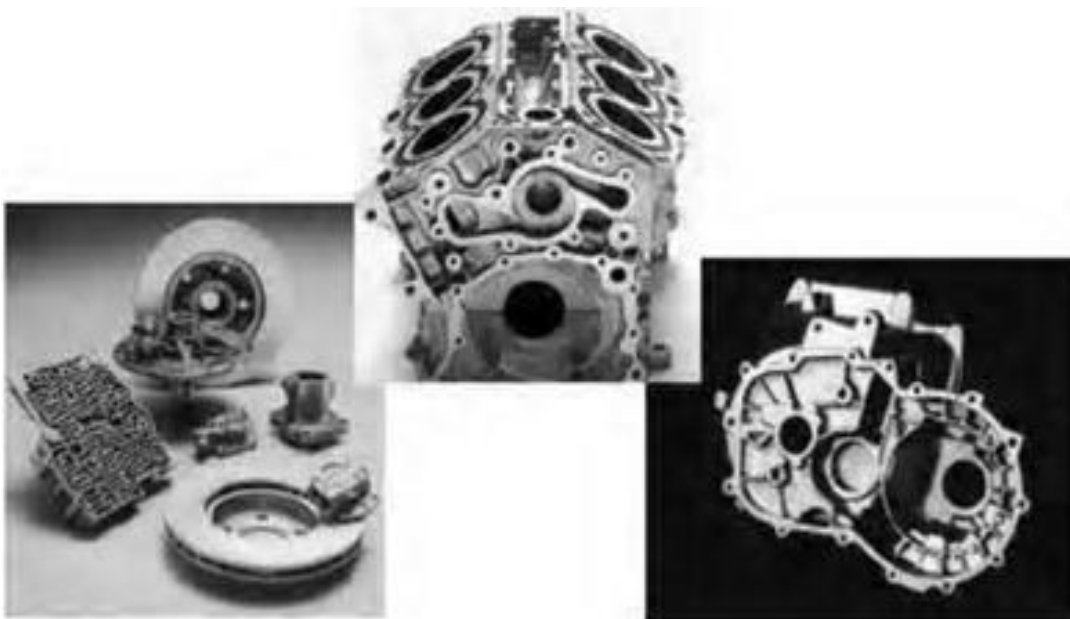


Figure 0: Metal Cast parts

Advantages

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

1 . Molten material can flow into very small sections so that intricate shapes can

be made by this process. As a result, many other operations, such as machining, forging, and welding, can be minimized or eliminated.

- 2 . It is possible to cast practically any material that is ferrous or non -ferrous.
- 3 . As the metal can be placed exactly where it is required, large saving in weight can be achieved.
- 4 . The necessary tools 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.

Limitations

- 1 . Dimensional accuracy and surface finish of the castings made by sand 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

History

Casting technology, according to records , reaches back almost 5,000 years BC . Gold , pure in nature , most likely caught Prehistoric man's fancy ... as he probably hammered gold ornaments out of the gold nuggets he found. Silver would have been treated similarly. Mankind next found copper, because it appeared in the ash of his camp fires from copper- bearing ore that he lined his fire pits with. Man soon found that copper was harder than gold or silver. Copper did not bend up when used. So copper, found a 'nitch' in man's early tools, and then marched it's way into Weaponry. But, long before all this ... man found clay. So he made pottery – something to eat from. Then he thought, "now ... what else can I do with this mud ... " . Early man thought about it, "they used this pottery stuff, (the first patterns), to shape metal into bowls " .

3200 BC . A copper frog, the oldest known casting in existence, is cast in Mesopotamia.

233 BC . Cast iron plowshares are poured in China.

500 A. D . Cast crucible steel is first produced in India , but the process is lost until 1750 , when Benjamin Huntsman **rein vents** it in England.

1455 Dillon burg Castle in Germany is the first to use cast iron pipe to transport water.

1480 Birth of Vannoccio Biringuccio (1480- 1539) , the "father of the foundry industry," in Italy. He is the first man to document the foundry process in writing.

1709 Englishman Abraham Darby creates the first true foundry flask for sand and loam molding.

1750 Benjamin Huntsman reinvents the process of cast crucible steel in England. This process is the first in which the steel is completely melted, producing a uniform composition within the melt. Since the metal is completely molten, it also allows for alloy steel production, as the additional elements in the alloy can be added to the crucible during melting. Prior steel production was accomplished by a combination of forging and tempering, and the metal never reached a molten state.

1809 Centrifugal casting is developed by A. G. Eckhardt of Soho, England.

1896 American Foundrymen's Association (renamed American Foundrymen 's Society in 1948 and now called the American Foundry Society) is formed.

1897 Investment casting is rediscovered by B.F. Philbrook of Iowa. He uses it to cast dental inlays.

1947 The Shell process, invented by J. Croning of Germany during WWII, is discovered by U.S. officials and made public.

1953 The Hotbox system of making and curing cores in one operation is developed, eliminating the need for dielectric drying ovens.

1958 H.F. Shroyer is granted a patent for the full mold process, the forerunner of the expendable pattern (lost foam) casting process.

1968 The Coldbox process is introduced by L. Toriello and J. Robins for high production core making. 1971 The Japanese develop V- Process molding. This method uses unbonded sand and a vacuum.

1971 Rheocasting is developed at Massachusetts Institute of Technology.

1996 Cast metal matrix composites are first used in a production model automobile in the brake rotors for the Lotus Elise.