

# Twin Roll Strip Casting of Magnesium Alloy

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**Abstract**— Twin roll strip the name itself indicates that the two same diameter of roll rotates in same direction the gap of the two roller pour the molten metal simultaneously solidification process takes place. In case of convections process chain for the manufacturing of a strip using roll bonding comparison many auxiliary operation. In convectional casting based on amorphous strip casting technology. In this technology the shape of the strip are insufficient but in advance casting overcome the drawback of convectional casting. In twin roll strip casting continuous produce strip by solidifying molten metal retained between rotating twin roll surface and attaching two solidified shell at the nip. The process has lower energy consumption and pollution free for conventional processes. The present review focused on technical progress in strip of last three decade.

Keywords- strip casting; Twin-Roll Casting (TRC), Horizontal Single-Belt Casting (HSBC) magnesium alloys

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## I. INTRODUCTION

The main aim of the casting is to manufacturing the thin and microstructure sheet metal. In this casting we will used the magnesium alloy is the for manufacturing the thin metal sheet, the main properties of magnesium alloy contains many superior mechanical properties low density, high specific strength, good die casting high performance and good in shock resistance. It is lightest structural metal. TRC mostly applied in electronic, automobile, military and aviation industry. Twin roll strip casting directly produce thin sheet by pouring the molten metal into two rotating pair of sphere the arrangement of the roll is automatically solidified the metal. In previous case the continuous casting powder and lubricant are used to the casting, power and lubricant are applied to the casting mold and slab is gradually pulled out while the mold is being vibrated. Because of vibration crack and uneven surface finishing will be arrived. But in advanced twin roll strip casting can make a strip is shorter time without powder and lubricant. Our main objective is to develop a finite element model of twin roll caster.

## II. LITERATURE SURVEY

The need of industry and scarcity of alloy Both think will be the issue of day to day life, in this paper gives the introduction about the magnesium alloy, the properties of the magnesium alloy is light weight material, lower density, higher specific strength as well rigidity. In brief study of semi solid continuous casting [3]. This paper found that semi solid continuous type of casting apply hot rolling process will be use

to enhance the plasticity of sheet. Principle and characteristic of twin roll strip caster is the main concept of the manufacturing in caster in previous case the continuous casting some extra auxiliary necessary to slab in continuous casting, powder and lubricant applied at the time of continuous casting, slab and mold is gradually pulled out since the mold is being vibrated. The extra auxiliary and the auxiliary cost is reduced in developed twin roll strip casting technology, twin roll strip casting developed thin sheet with short time without applying powder and lubricant, time period of the solidification is extremely short as compare to slab continuous casting this type of production method is very high speed[6].

Development of a rolling technology with the use of twin roll cast by using magnesium alloy strips, high quality products and heavy material not applicable in automobile industry, in convectional casting method high production rate but complex production structure installation. But development of rolling technology for producing a strip with dimension nearest to the final product also reduced the number of steps [7].

The Review gives the author of vertical of vertical type of casting in this paper not only gives the information about casting but they also achieve the understanding about microstructure evaluation and to produce safe and quality strip Prof Seshadev sahuo gives the review for vertical casting process the comparison between convection casting and vertical twin roll strip casting reduction of the rolling process step ultimately reduced the labor cost as well as saving the energy as compare to convectional casting, also they will

conclude that hot rolling process will be eliminated in twin roll strip casting[8].

### III. PROCESS

In twin roll strip casting microstructure and mechanical of the solidified material depends upon solidification behavior. The solidification process depends upon various parameter when a liquid nozzle leave and contact of roll surface, solidification process being against the two rolls by losing heat liquid mold metal to the roll surface, as a result formation of two shell grows in thickness and process will be continued forward through the metal pool. At the end they will contact with each other of the two rollers. This allows a better support or touching of the two shells to each other. Avoiding or minimizing void and porosity in the center of the twin roll strip. The solidification phenomena in twin-roll strip casting process depend on the following process parameters of twin-roll strip caster

- i. Diameter of the roll
- ii. Roll material
- iii. Casting speed
- iv. Roll gap
- v. Metal-roll heat transfer coefficient

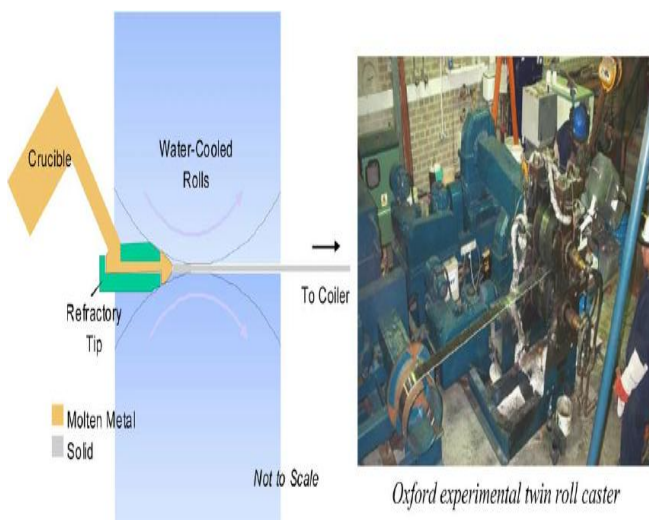


Figure 1. Basic diagram for Twin Roll Strip Process.

### IV. PRINCIPLE AND CHARACTERISTIC OF TWIN ROLL STRIP CASTING

A twin roll strip caster continuously produces strip by solidifying molten metal at the time of casting [6], twin roll strip caster can make a strip nearest to final product without any auxiliary as like a powder and lubricant, The principle advantage of the twin roll strip casting thin strip directly produce from the liquid metal without any cooling source casting and rolling in a single step, the process control the mechanical as well as thermal properties. The success of twin roll strip casting is to eliminate the hot roll strip casting [2], the

nozzle leave the molten metal and touch the roller surface solidification process occur because of arrangement of the two counter rotating roller losing heat from liquid slurry to solid metal. Also the advantage of the advance casting is use the cheapest input material with no heating provided with succeeding rolling process [4], in convection method of casting high production rate but complex in production installation separate roller, finishing line etc. Thickness of the twin roll strip casting of about 0.1 mm to 6mm depending upon the roller gap [5].

- A graph within a graph is an “inset”, not an “insert”.
- There is no period after the “et” in the Latin abbreviation “et al.”.
- The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

An excellent style manual for science writers is [7].

### V. METHODOLOGY

The first priority is safety and comfort as well as increasing day to day cost of fuel lead to rising demand of the automobile industry the various factor can be considered in this research. The technique should perform several stages such as vertical twin roll strip casting and horizontal strip casting.

- a. Single roll strip casting:-single roll strip caster was first developed in US based on amorphous strip casting technology. Single roll casting based on the principle of strip is produced by using a rotating substrate. In this method the rate of heat extraction and to control the shape of strip are insufficient which results in deterioration of shape and quality of the strip.
- b. Twin roll strip casting:- Overcome the drawback of single-roll strip casting the advance technology of casting process was established by Sir H. Bessemer, in twin roll strip casting a twin roll strip caster continuously produces strips by solidifying molten steel retained between rotating twin roll surfaces and attaching two solidified shells at the nip.

### TYPES OF TWIN ROLL STRIP CASTING

- i. Vertical twin roll strip casting
- ii. Horizontal twin roll strip casting

I. Vertical twin roll strip casting:-

**Twin Roll Casting**

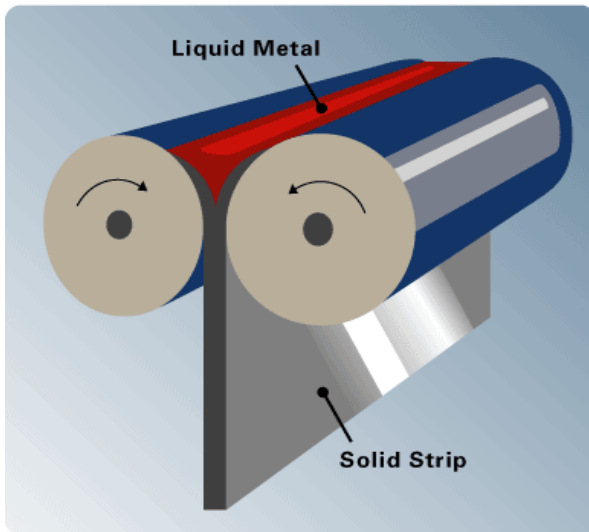


Figure 2. vertical twin roll strip casting.

Vertical twin roll strip casting is widely applied in the steel industry the selection is mostly based on the required cooling efficiency of a casting as well as thermal properties of the applied material. The most used full advantage of Vertical twin roll strip casting is faster casting speed.

Effective cooling are 300-400K at a diameter 850mm. the cooling rate is also high as compare to horizontal twin roll strip casting (100-1)(K.S). Cooling speed is higher than horizontal twin roll strip casting but in vertical twin roll strip casting uniform melt distribution is different controlling melt pool height is also not easy in Vertical twin roll strip casting. Thickness of cast strip is less as compare to horizontal twin roll strip casting. The main application Vertical twin roll strip casting of casting is more suitable for production of thin magnesium alloys with fine grain for application computer communication, consumer-electronic or molten products

Types of vertical twin roll strip casting:-

a) Non submerged nozzle Twin Roll Strip Casting:-

In non-submerged nozzle Twin Roll Strip the metal surface of the pool is directly contact with the roller. The main surface point and the roller point can be fluctuated hence the metal surface will be harm the stability of the primary solidification get rapidly decreases.

b) Submerged nozzle Twin Roll Strip Casting:-

In this type of submerged nozzle casting is used in common production. In this case a submerged nozzle in the metal pool is use to feed the molten metal from a holding tundish. In this type of casting, ceramic are often to adopted for avoiding the edge dam to prevent the leakage.

II. Horizontal twin roll strip casting:-

Horizontal twin roll strip casting is more popular for nonferrous alloy the selection mainly based on thermal properties of alloy, Horizontal twin roll strip casting is generally applied on Aluminum alloy because of thermal properties, Horizontal twin roll strip casting more beneficial for producing wide sheet, and thus few our able uniform microstructure the main application of horizontal twin roll strip casting is Traffic and transport tools are the potential for sheet for Horizontal twin roll strip casting m casting

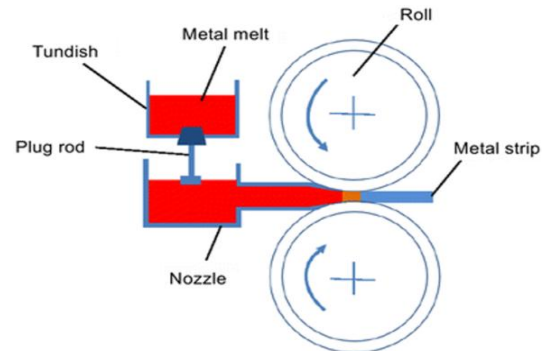


Figure 3. Horizontal twin roll strip casting.

VI. CONCLUSION

- Twin roll strip can improve the rate of production process and quality of product, in this casting low equipment cost low running cost, energy saving, space saving
- Cooling speed of vertical twin roll strip is higher than horizontal twin roll strip casting
- Solidification process takes place at the time of casting, without any external sources. Installation is easier as compare to convectional casting.
- Microstructure strip can easily manufacture without any amorphous behavior and did not two different surfaces like a previous single twin roll strip casting technology.
- The demand of light weight material in industry and automobile sector can be fulfill.
- But the drawback of twin roll strip casting is only applicable for manufacturing the thin sheet not applicable for the heavy product like gear, turbine, wheels etc.

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