CHAPTER - 2

LITERATURE REVIEW
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LITERATURE SURVEY

2.1. INTRODUCTION

This section presents a comprehensive review of literature related to performance enhancement studies in foundry.

2.2. PULL-DOWN DEFECTS

- Alagarsamy (2003) considered employing a disciplined approach to understand nature of defect, mechanism of defect formation and controlling key process factors to reduce rejections.
- Coudurier et al (1978) had mentioned in his work that volumetric contraction as about 1.4% per 100°C for cast iron.
- Darken and Gurry (1953) had stated in their work that an increase in pouring temperature of 50°C might increase need for feed metal by 0.7%.
- Heine (1979) found that ceramic filter reduced modulus locally and blocked feeding path.
- Mullins (2001) explored that primary austenite induced pull-down defect and suggested correct carbon equivalent to reduce amount of pull-down.
- Mullins (2001) had guided that chemical composition could alter nucleating tendency of cast iron.
- QIT-Fer et Titane Inc (1987) had established that small modulus ingate led to feed metal lacking
- Richins and Wetmore (1951) had identified that increasing carbon equivalent content reduced pull-down tendency in cast irons.
• Sillen (2002) studied various techniques and suggested to choose pouring temperature for each type of casting to minimize volume contraction in liquid state.

• Swift et al (1949) had mentioned that insufficient amount of feed metal at early stages of solidification aggravated pull-down defect.

• Vijayaram (2006) had studied techniques to improve quality of castings without increase in price.

2.3. INTERNAL DEFECTS

• Alagarsamy (2003) mentioned that presence of defects in un-machined areas hampered safety of product. This researcher suggested moisture content for molds.

• Alagarsamy (2005) identified that Iron-phosphide segregated to cell boundaries and continued to contract further even after most of alloy had solidified.

• Calcom (2003) considered that internal centre defects occurred due to heat distortion.

• Dhole (2005) explored that high residual magnesium levels caused magnesium segregation and induced formation of carbides, which contracted and created defects.

• Elkem (2004a) mentioned that maximum allowable content of phosphorus as 0.05%.

• Elkem (2004b) considered that higher liquidus temperature than normal promoted feeding difficulties. This publication suggested for limitations in sulfur and manganese content.
Elkem (2004c) focused that late inoculation led to expansion of graphite at an early stage.

Elkem (2004d) concluded that residual magnesium level is consistent with thermal modulus of casting.

Heine (1979) mentioned that feeding system be designed such that molten metal reached critical areas in casting and is available during contraction period.

Mullins and Muratore (1998) mentioned that excess primary austenite and graphite induced internal defects.

Mullins (2001) observed that micro defects are formed between solidifying dendrites and as a metallurgical problem. This publication further reviewed that internal defects are also caused due to faulty feeding system.

Naro (2000) mentioned that porosities as metallurgical problem dependent on chemical composition. The publication recommended for maintaining mold hardness.

Pechiney (1995) opinioned that mold wall movement increased likelihood of internal defect.

Popovski (2004) mentioned that excess inoculation reduced cell size and promoted high growth rate of graphite.

QIT Fer ET Titane (1987) recommended for a feeder with medium modulus.


Sillen (2002) found that internal defect occurred towards end of solidification. This publication had further informed, nucleation is reduced by super heating or prolonged holding.
• Skaland (2001) explored that inoculation level to have a low initial growth rate of graphite.

• Sylvestro (2000) recommended for addition of lustrous carbon and suggested a range.

2.4. FURNACE PRODUCTIVITY

• Beaird (2003) mentioned that sintering as action of bonding boric acid and silica to create an optimum ceramic ‘hot face’ to have minimum saturation.

• Beaird (2003) recommended to avoid super heating of low heel

• Bonnaci (2002) explored that fitting caused complete fusion and developed enough hot strength to withstand liquid metal pressure and churning.

• Carniglia and Barna (1992) mentioned that B-grade as combination of small quantities of feldspar.

• Doza (1995) explored that wear occurred due to thermal stress, continuous churning of liquid metal, wear is more pronounced in high and medium frequency furnaces.

• Doza (1998) suggested that combination of A and B-grade are most suitable for induction furnace.

• Green (1996) recommended particulars and mesh sizes of ramming mass for use in induction furnace.

• Inductotherm (2007) mentioned that chemical reaction between slag and lining increased rate of lining erosion.

• Patel (1991) classified silica-ramming mass into three types and in which A-grade contained purest form of silica. This publication recommended binder
addition for steel melting and for cast iron. It also informed method for mixing binder. Further mentioned to dry ramming mass to avoid steam Spalling.

- Stark (1991a) mentioned that linings be replaced promptly when they wear down to prevent failure.
- Stark (1991b) recommended alternate use of fork and flat rammers for uniform compaction.
- Stark (1991c) and Stark (1991d) outlined effect of concentric placement of melt out former to prevent uneven wear.
- Williams and KO (2006) advised for a smooth tapered former. This publication further mentioned that wear is more pronounced at active power coil area with low volume of liquid metal. They also opinioned that low silicon metal enhanced elephant’s foot wear. Recommendation included as steel scrap be charged when liquid bath is half filled.

2.5. RESOURCE UTILIZATION

- Arenales (2002) studied a foundry, which had one furnace and several molding machines producing a known demand of items, which could be made of different alloys.
- Bonczek et al (1980) defined decision support system as a computer based system containing of three interfacing components and are language, knowledge, and problem processing system.
- Clark et al. (in press) proposed a mixed integer program to model production planning and scheduling in small foundries.
• Mathirajan et al (2005) had studied problem of minimizing total weighted tardiness in heterogeneous batch processing machine under the conditions of dynamic job arrivals, incompatible job families, and non-identical job sizes.

2.6. SUMMARY

The review of literature reveals the following:

• Scope of process tuning is immense

• Variety of parameters had been studied and analyzed independently for iron casting process.

• Resource utilization had been given little attention and very general.

On consideration of above, this thesis aims to enhance the performance of a foundry by applying scientific principles and modern techniques.