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EFFECT OF ZINC MELT CORROSION ON INJECTION PISTON AT HOT CHAMBER PRESSURE DIE CASTING

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ABSTRACT:
At hot chamber pressure pressure die casting zinc melt corrodes the injection piston from grey cast iron and lowers its life. Zinc die casting offer outstanding physical and mechanical properties with excellent castability and finishing characteristics.
KEYWOORDS:
pressure die casting, zinc melt, hot chamber

1. INTRODUCTION

One of the important task of scientific field is the research not only on thermal and pressure conditions during pressure die casting process but also the study of zinc melt corrosive effect

The interaction process of the zinc melting with the injection piston is analysed with final factors that have influences on its life-cycle.

2. PRINCIPLE OF HOT CHAMBER PRESSURE DIE CASTING

In practise there are two types of pressure die casting machines depending on permanent or provisional contact with the device on which the press we affected [5]:

1. Hot-chamber pressure die casting machines,
2. Cold-chamber pressure die casting machines.

The basic principle of hot chamber pressure die casting is illustrated in figure 1 that shows schematically the basic function.

In the beginning the melted metal is fed from the maintaining furnace into the sleeve chamber. The metal is transferred through the channel into the die cavity and solidifies on a casting. After die opening it is ejected from the cavity.

Finally, referring to the drawing, molten zinc metal is injected at a high pressure into the cavity and the zinc metal is moulded to form a basic casting product [6].

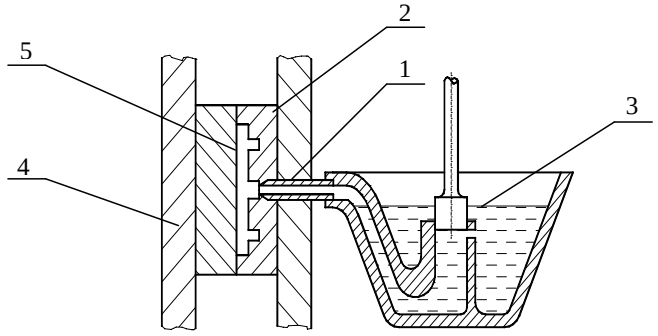

Figure 1. Schematic principle of hot chamber pressure die casting in melting system injection piston, 2 - movable part of die, 3 - molten zinc, 4 - stationary part of die, 5- casting,

3. EXPERIMENT, PROCESS AND THE RESULTS OF RESEARCH OF ZINC MELTING CORROSIVE EFFECT

It was necessary to discover the detailed analysis of relation between zinc alloy and the irregularity in the hot dissolving. The performances are preheated into the blow molding.

At hot chamber pressure die casting with regard to fast kinematic motion and effect of molten zinc alloy the injection plunger usually made of grey cast iron and provided by steel rings is one of the most stressed parts of injection mechanism which are in contact with zinc melt.

Interaction process of molten zinc alloy with the injection piston is analysed from the standpoint of factors influencing its durability. As a starting point for theoretical analysis with regard to great complexity of the system grey iron/zinc melt is used analysis including cycling of pressure die casting process and going out from judging of various factors that are of use.

At the grey iron the range graphite-matrix has the highest concentration of defects and internal energy with regard on different structures.

The molten zinc alloy in sense of internal energy decreasing causes dissolving primarily in this area according to the arrowheads 1 in the figure 2.

There are two pearlite and ferrite phases in the matrix. The range of these two phases is the further example of defects and higher internal energy. With regard on decomposing the phases and their smaller differences of the concentration of defects is smaller. The zinc melting dissolves this area secondarily according to the arrowheads 2 in the figure 2.

There is a certain uncohorentness on the bounds of pearlitic colonies, too. The concentration of defects is the smallest with regard on similarity of neighbouring phases.

The molten zinc alloy dissolves these boundaries marked with the arrowheads 3 in the figure 2 in the third series.

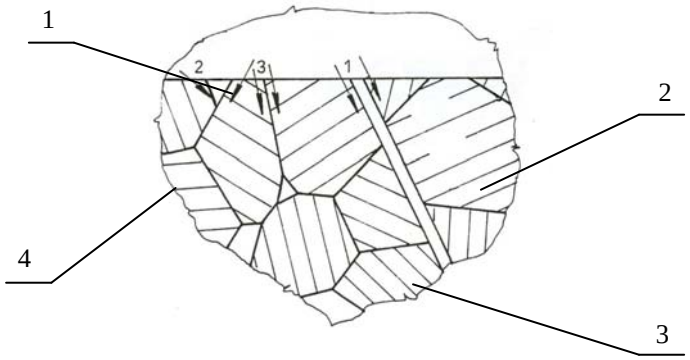

Figure 2. Scheme of interaction of zinc melting alloy on the arrowheads
1- molten zinc alloy, 2- pearlitic colony, 3- graphite, 4-ferrite

Dissolving the zinc alloy is cyclic and works always during the i-th casting cycle during the injecton that the front of the zinc alloy advances the section 1 according to the figure 2.

Figure 3. Corrosive dissolution

Then whole length of the zinc alloy advance after the i-th cycle.

$$l = i.\Delta l \qquad [m] \qquad (1)$$

where is:

i - number of casting cycles

Δl - the length of the advance effecting front of the zinc alloy at one casting cycle [m]

l - the length of the advance affecting front of the zinc alloy after the i-th casting cycle [m]

Then through the advance according to the arrowheads 1,2,3 in fig.2 the certain areas of the plunger area bordered and dissolved towards the inside gradually. By merging the more attacked areas the new interface of the molten alloy and the plunger is made.

The dissolving advance runs according to the competent phase diagrams. By the change of the original correct geometry the plunger rings are attacked least. The durability of this plunger is higher than the one without rings.

4. CONCLUSION

The detail of the primarily affected interface graphite-pearlite is on the figure 3. The interface of pearlitic colonies is attacked by the alloy fast simultaneously or with smaller intensity. Then the pearlitic colonies, graphite and pearlite are swum out into the molten alloy where they are dissolved gradually.

REFERENCES

[1] Malcev M.V., Baroukova T.A, Borin F.A.: Metalography of non-ferrous metals and alloys. SVTL Bratislava, SNTL Praha, 1963
[2] Grigerova T., Lukač I., Koreny R.: Foundry of non-ferrrous metals. ALFA Bratislava, 1988
[3] Valecky J. and col.: High die casting. SNTL Praha, 1963
[4] Roučka J.: Metalurgy of nonferrite. CVUT Brno, 2004
[5] Andrejčák I., Molnár V.: Die casting technology. ISBN 80-7099-743-5, TU FVT Prešov, 2001
[6] Ragan E.: Metal casting process under the pressure. ISBN 80-7099-268-9, TU FVT Prešov, 1997
[7] Malík, J., Džupon, M., Komár,J.: Chyby odliatkov liatych do kovovej formy pod tlakom. ACTA Metallurgica Slovaca 11, n.3, p.138-141, ISSN 1335-1532