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## THERMAL ANALYSIS OF THE ZnAl10 ALLOY MODIFIED BY Ti ADDITIONS IN AlTi3C0.15 AND ZnTi3.2 INOCULANTS

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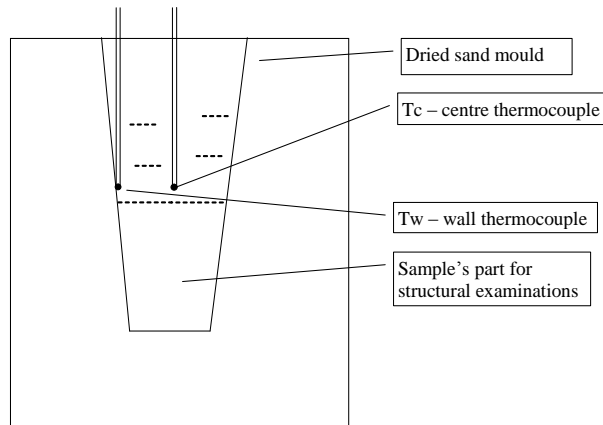
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### 1. Introduction

Cast alloys on the Zn matrix and of an increased Al content are characterised by good technological and mechanical properties, due to which they should meet special, more demanding requirements. However, the basic problem in these alloys technology, apart from a high tendency for gases pick-up and oxidation of liquid metals, is a tendency to form coarse-grained dendritic structures in castings solidifying in sand moulds, what - in turn - unfavourably influences their plastic properties [1, 2, 7, 11]. Therefore several treatments aimed at obtaining fine-grained structure and improving plastic properties are applied in these alloys technology. The presented study concerns the modification process of binary, middle-aluminium Zn alloys performed by additions of inoculants containing titanium and investigations of these modifications influence on the structure refinement degree. The Zn-10wt% Al (ZnAl10) alloy modified, before pouring into a sand mould, either by addition of the traditional inoculant i.e. Al-3wt% Ti-0.15wt% C (AlTi3C0.15 – TiCaI) or the new inoculant Zn-3.2wt% Ti (ZnTi3.2) was tested. Within investigations the thermal analysis was performed, especially cooling curves and their first derivatives, and also measurements by means of the differential scanning calorimetry (DSC), with a purpose of determining the modification influence on undercooling degree changes. Microstructures of the tested alloy were observed by the light microscopy (LM). The applied modification of middle-aluminium zinc alloys by AlTi3C0.15 and ZnTi3.2 inoculants causes a significant refinement of the alloy structure. Inoculants applied in investigations have a strong nucleating activity, which is confirmed by decreasing of undercooling and the temperature recalescence in cooling curves, which occurs simultaneously with grain refinements.

### 2. Experimental

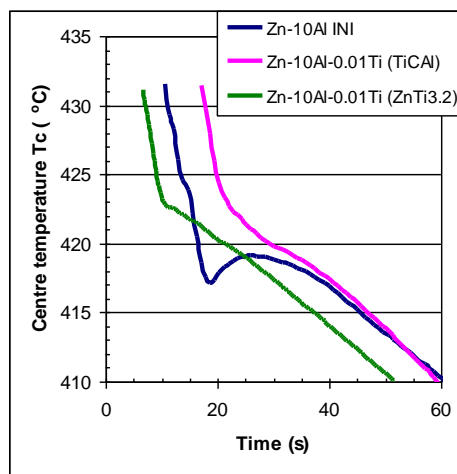
The investigation results obtained for ZnAl10 alloy are presented in the paper. The hereby study is devoted to investigations aimed at the determination of the modification process influence on the degree of fineness of the middle-aluminium Zn alloys structure. The traditional TiCaI inoculant and the new ZnTi3.2 inoculant, were applied. Both inoculants are good carriers of titanium, the strongly nucleating element. The sand mould application allowed to eliminate - to a high degree - the influence of the cooling rate on the casting grains refinement, which occurs when metal mould is used and makes difficult the modifier effectiveness assessment. Measurements of cooling curves in the sand mould, which schematic presentation is given in Figure 1.



**Fig. 1.** Schematic sketch of the sand mould

### 3. Results and discussion

Cooling curves of the initial, not modified ZnAl10 alloy and after the modification are presented in Figure 2. It can be noticed that both modifying inoculants cause shifting the crystallisation start temperature in the direction of higher temperatures and cause decreasing and decaying of undercooling.



**Fig. 2.** Comparison of first periods of cooling curves for initial and modified ZnAl10 alloy

The modification influence on the alloy microstructure (Fig. 3) is mainly manifested by limiting the dendrite growth and by increasing their numbers. Their shapes are also changing. From strongly branched they are becoming more coagulated and compact. The eutectic fraction in also increased.



**Fig.3.** Microstructures of the ZnAl10 alloy: a) Initial, not modified, b) Modified by 100 ppm Ti in the ZnTi3.2 inoculant, c) Modified by 100 ppm Ti in the AlTi3C0.15 inoculant

#### 4. Conclusions

On the bases of the performed investigations and obtained results it can be stated that the application of the modification process of middle-aluminium zinc alloys by the addition of 100 ppm of Ti in the AlTiC0.15 and ZnTi3.2 inoculants causes a significant refinement of the structure components. The crystallisation starts at a temperature higher by app. 5°C in comparison with the initial, not modified alloy, which is also indicated by nearly complete decay-ing of undercooling. In addition on the recorded cooling curves the temperature recalescence occurring simultaneously with grains refinement, is clearly seen. The obtained results allow to state that creation of new crystallisation nuclei in the modified alloy occurs according to the heterogeneous nucleation mechanism.

#### Acknowledgements

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