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THE EFFECT OF GRAIN-REFINEMENT ON Zn-10Al ALLOY DAMPING PROPERTIES

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1. Introduction

ZnAl-based foundry alloys of increased Al content have enhanced damping properties. On the other hand they show a coarse grain-structure after solidification in sand moulds, which decreases their ductility. The refinement of the coarse macrostructure positively influences plastic properties but the increased structure fineness can decrease the damping properties. This work is aimed at presenting results of the influence of Zn-10Al sand-cast alloys grain-refinement with the Al-3Ti-0.15C master alloy on the alloy damping properties measured by the attenuation coefficient changes.

2. Experimental

The system used during these examinations was Zn-10 wt.% Al (Zn-10Al) binary alloy inoculated with the commercial Al-3 wt.% Ti – 0.15 wt.% C Al-3Ti-0.15C TiCAl) master alloy. The Zn-10Al alloy was melted from Zn and Al of min. purity 99.99%. The melting, casting and inoculation of the Zn-10Al was performed in the same manner as previously described in detail in [1 – 3]. The measurements of damping properties were performed using the Krautkramer USLT 2000 device and the attenuation of 1 MHz ultrasound wave - Fig. 1, [3 – 5].

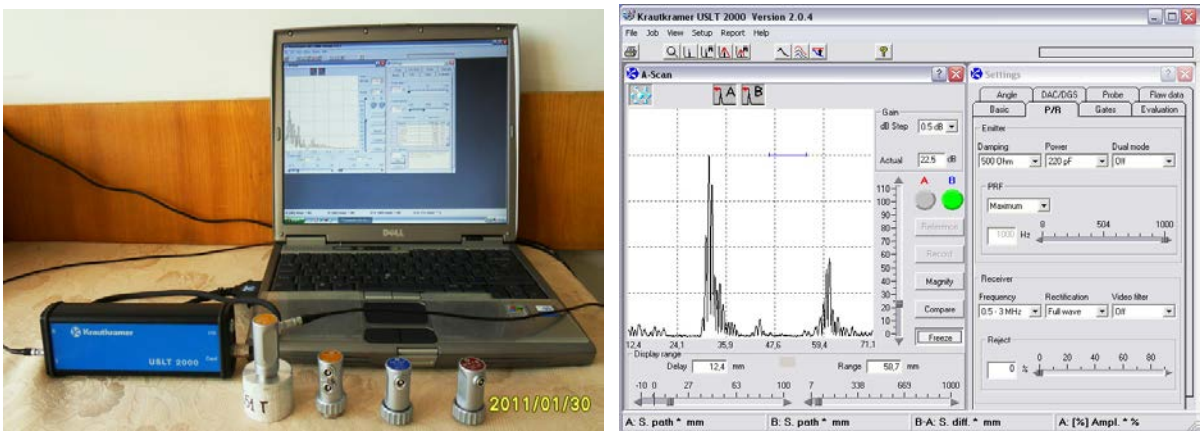

Fig. 1. Left: Krautkramer USLT 2000; Right: Exemplary image of peaks in an echogram of the examined Zn-10Al alloy

1 and 2 – PhD students at the Department of Engineering of Foundry Processes; 3 – PhD Eng., Adjunct at the same Department; 4 – Professor and Head of the same Department

3. Results and discussion

The results of the attenuation coefficient changes vs. addition of Ti, obtained during the performed measurements, are shown in Fig. 2. From the Fig. 2 it can be seen that the addition of TiCAl master alloy, in the amount of about 25 - 400 ppm, generally decreases the attenuation coefficient with comparison to the initial, no nodified alloy. However, the observed decrease is only 15 – 25%, so also detail examinations on the influence on strength properties should be performed to evaluate a total influence of the applied inoculation on the mechanical properties. This will be presented in a close future in [5].

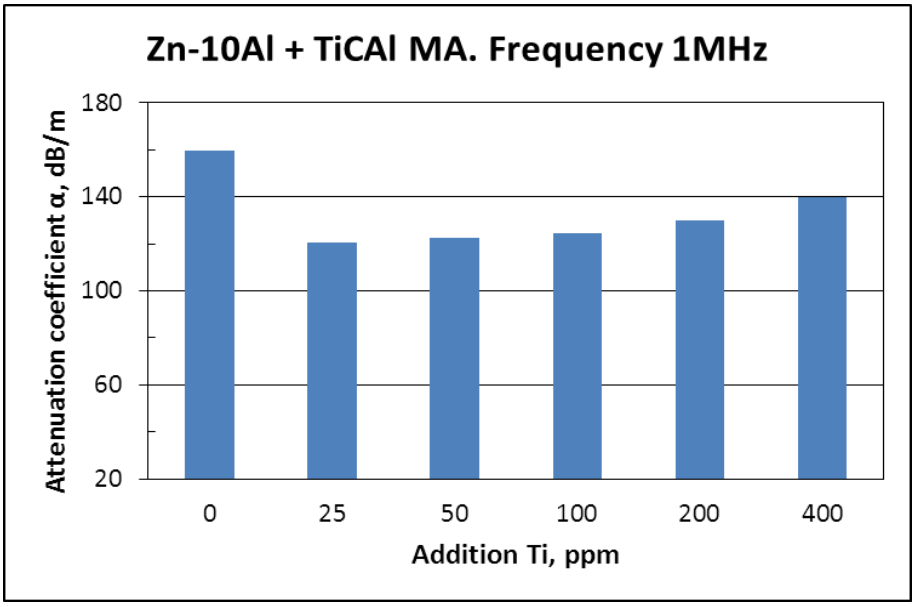

Fig. 2. Summary of the effect of the addition of Ti in the Al-3Ti-0.15C (TiCAl) master alloy on the mean value of attenuation coefficient

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References

[1] W.K. Krajewski, J. Buras, M. Zurakowski, A.L. Greer, Structure and properties of grain-refined Al-20wt% Zn sand cast alloy. Archives of Metallurgy and Materials, vol. 54, issue 2 (2009) 329-334

[2] K. Haberl, W.K. Krajewski, P. Schumacher, Microstructural Features of the Grain-refined Sand Cast Alloy AlZn20, Archives of Metallurgy and Materials, vol. 55, issue 3 (2010) 837-841

[3] J. Buras, The influence of grain refinement on damping properties of selected aluminium zinc cast alloys. PhD thesis supervised by W.K. Krajewski, AGH University of Science and Technology - Faculty of Foundry Engineering, Krakow 2011 (in Polish)

[4] W.K. Krajewski, K. Haberl - Faerber, J. Buras, P.K. Krajewski, Damping properties vs. structure fineness of the high-zinc aluminum alloys, Archives of Foundry Engineering, vol. 12, issue 3 (2012) 63-66

[5] W.K. Krajewski, A. Lindsay Greer, P.K. Krajewski, G. Piwowarski, Grain refinement of zinc-aluminium based foundry alloys, Accepted to 71st World Foundry Congress, Area: Non Ferrous and Light Alloys, Bilbao, Spain, 19-24 May 2014