Analysis of Causes of Al_2MgO_4-Type Spinel Inclusions Formation in Al-Mg Alloys during Low-Pressure Casting

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The aim of the research was to identify and analyze the nature and causes of black inclusions formation on a cast surface of AlMg3 alloy. Forms used in tires production are made of AlMg3 alloy by low-pressure casting technology. Four areas with the same shape and coloring of inclusions are marked on the figure Fig. 1. These areas underwent macroscopic and microscopic analysis. In regions of inclusions appearance several surface EDS analyzes were performed with the aim to determine chemical composition of the inclusions. EDS analyzes showed that the inclusions are in fact Al_2MgO_4-type spinel inclusions which appear for Al-Mg alloys with higher amount of Mg (above 1 – 2 %). As far as the theory of the problem is concerned, possible causes of spinel inclusions formation are described in the literature [1, 2, 3, 4]. Other possible causes of spinel inclusions formation considering low-pressure casting of AlMg3 alloy found during long-term research of low-pressure casting of Al-Mg type alloys are mentioned in [5].

Keywords: spinel inclusions, low-pressure casting, AlMg3 alloy, EDS analysis, macroscopic and microscopic analysis

References

[1] BOLIBRUCHOVÁ, D., TILLOVÁ, E.: *Zlievárenské zliatiny* Al-Si, ŽU v Žiline – EDIS, 2005, ISBN 80-8070-485-6.

[2] MICHNA, S., LUKÁČ, I. a kol.: *Encyklopedie hliníku*, 720 str., Adin s.r.o., Prešov SR, 2005, ISBN 80-89041-88-4.

[3] MICHNA, S., LUKÁC, I.: *Barevny kontrast, struktury a vady u hliniku a jeho slitin*, 214 str. Delta Print, Děčín, ČR, ISBN 80-239-1636-X.

[4] LUKÁČ, I.; MICHNA, S.: *Colour Contrast, Structure and Defects in Aluminium and Aluminium Alloys*, pp. 168, September 2001, Cambridge International Science Publishing GB, ISBN 1-898326-70-3.

[5] MONDOLFO, L. F.: *Aluminium Alloys, Structure and Properties*, Butterworths, London 1979.

[6] MICHNA, S., KUŚMIERCZAK, S.: *Praktická metalografie*, UJEP v Ústí nad Labem 2012, ISBN 978-80-7414-503-2.

[7] NOVÁ, I., SOLFRONK, P., NOVÁKOVÁ, I.: *Vliv množství dislokací na tvařitelnost slitin hliníku*, Strojírenská technologie, XVI/2, r. 2011, str. 28-34, ISSN 1211-4162.

[8] VAJSOVÁ, V.: Structural inhomogeneity by Al-Cu alloys casting into metal and bentonic form. *Transactions of the Universities* of Košice, r. 2009, č. 1. ISSN 1355-2334.

[9] MICHNA, Š., NÁPRSTKOVÁ, N., LUKÁČ I. : Mechanical Properties Optimization of AlSi12CuMgNi Alloy by Heat Treatment. *Metallofizika i Noveishie Teknologii*, 11 / 2011, ISSN 1024-1809.

[10] VAJSOVÁ, V., MICHNA, Š.: Optimization of AlZn5,5Mg2,5Cu1,5 Alloy Homogenizing Annealing, *Metallofizika i Noveishie Teknologii*, Volume 32, No 7, July 2010, str. 949 – 959, ISSN 1024-1809.

[11] MICHNA, Š., MAJRICH, P.: An analysis of the Process of Melting Food Packaging and Acquiring the Aluminium Alloy, *Металлург*, 11/2012, ISSN 0026 – 0827 (IMPACT).

[12] MICHNA, S., NÁPRSTKOVÁ, N.: Research into the causes cracking of aluminum alloys of Al – Cu during mechanical machining, *Manufacturing Technology*, vol. 12, No. 12, June 2012, pp. 47-51, ISSN 1213-2489.

[13] WEISS, V., STŘIHAVKOVÁ, E.: Influence of the homogenization annealing on microstructure and mechanical properties of AlZn5,5Mg2,5Cu1,5 alloy, *Manufacturing Technology*, vol. 12, No. 13, December 2012, pp. 297-302, ISSN 1213-2489.

[14] WEISS, V., KVAPILOVÁ, I.: Assessment of the effect of temperature and annealing time homogenization AlCu4MgMn alloys in terms of microstructure image analysis methods and EDX, *Manufacturing Technology*, vol. 13, No. 1, March 2013, pp. 123-127, ISSN 1213-2489.

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