Light Metals 1996: Proceedings Of The International Symposium On Light Metals 1996, Montraeal, Quaeb

435

Canadian Metallurgical Quarterly, Vol 44, No 4 pp 435-448 2005
© Canadian Institute of Mining, Metallurgy and Petroleum
Published by Canadian Institute of Mining, Metallurgy and Petroleum
Printed in Canada. All rights reserved

OXIDE INCLUSION DEFECTS IN Al-Si-Mg CAST ALLOYS

X. CAO[1,2] and J. CAMPBELL[1]

[1]Department of Metallurgy and Materials, University of Birmingham, Birmingham, United Kingdom
[2]Aerospace Manufacturing Technology Centre, Institute for Aerospace Research, National Research Council Canada, Montreal, Quebec, Canada

(*Received in revised form May, 2005*)

Abstract — Oxide films on the surface of liquid aluminum alloys are entrapped in castings to form stable solid inclusions as a consequence of surface turbulence. The oxide film defects are highly damaging to aluminum alloy castings because of their nature as cracks. The oxide films or particles observed in Al-11.5Si-0.4Mg cast alloys include Al_2MgO_4, Al_2O_3, MgO and SiO_2. The paper discusses the identification, main features and formation mechanisms of oxide inclusions in Al-11.5Si-0.4Mg cast alloys combined with an overview of the oxide inclusions from a number of publications to summarize the central importance of oxide films in the development of the structure of Al-Si cast alloys. To produce reliable castings, the removal of oxide films from aluminum melts and the avoidance of the entrapment of oxide films during metal melting, delivering, transferring and pouring remain a great challenge for the metal casting industry.

Résumé — Les films d'oxyde à la surface d'alliages d'aluminium liquides sont piégés dans les moulages formant ainsi des inclusions solides et stables comme conséquence de la turbulence superficielle. Ces films d'oxyde sont extrêmement nuisibles aux moulages d'alliage d'aluminium à cause de leur nature en forme de fissures. Les films d'oxyde ou les particules observés dans les alliages moulés d'Al-11.5Si-0.4Mg incluent Al_2MgO_4, Al_2O_3, MgO et SiO_2. Ce document discute de l'identification, des principales caractéristiques et des mécanismes de formation des inclusions d'oxyde dans les alliages moulés d'Al-11.5Si-0.4Mg. On fait également une revue des inclusions d'oxydes à partir de plusieurs publications, résumant l'importance essentielle des films d'oxyde dans le développement de la structure des alliages moulés d'Al-Si. Afin de produire des moulages fiables, la suppression des films d'oxyde des bains d'aluminium ainsi que la prévention de leur piégeage lors de la fonte du métal, de la livraison, du transfert et du coulage restent un grand défi pour l'industrie de moulage du métal.

INTRODUCTION

Oxides in liquid aluminum are stable solid inclusions. Some oxides are in the form of extended or convoluted films together with their entrained layer of air and are nearly neutrally buoyant, which greatly impedes their separation from the aluminum melts. Thus, liquid aluminum usually suffers from oxide films present in copious quantities as is now well demonstrated in some recently published accounts [1,2]. If care is not taken to remove such suspended debris in the melts and to avoid the re-entrapment of oxides during melting, delivering, transferring and pouring of liquid metal, they can lead to a variety of problems [1,3]:

1. Loss of fluidity and feeding properties. As a result, the amount of microshrinkage may increase.
2. Increase in porosity. Gas coated films (inclusions) act as sites for the initiation of hydrogen bubbles or shrinkage cavities.
3. Increase in the tendency for hot tearing. The folded oxide films can be opened during freezing to create hot tears or may remain in the frozen castings as cracks.
4. Leakage defects. Folded oxide films can provide leakage paths by connecting wall to wall in castings. Bubble trails and non-wetted confluences of melt fronts are also particularly troublesome with respect to leak tightness.
5. Poor machinability. Extremely hard and brittle oxides usually lead to a poor machined surface finish and increase tool wear and damage.
6. Reduction in the mechanical properties of castings. Oxide films as cracks in castings introduce structural weakness causing the reduction and scatter of strength, ductility or fatigue resistance. The large and uncontrolled

Polariton-Mediated Light Scattering Light metals proceedings of the International Symposium on Light Metals , Montreal, Quebec, Aug. Optimized.By: International Symposium on Light Metals Processing and Applications, (, Published: (); Challenges in process intensification: proceedings of the Published: Montreal, Quebec: Canadian Institute of Mining, Metallurgy and.International Symposium on Extraction, Refining and Fabrication of Light Metals, 24, p. Dans: Light Metals Proceedings of the Technical Sessions Presented by international annual forum , May , Montreal, Quebec.The Japan Institute of Metals . and D. Ksinsik (Proceeding of the international symposium on Light Metals , Montreal, Canada,) pp. Degradation of Materials and Corrosion Control in Metals, Quebec, Canada,) pp."Mechanical Behavior of Alumina Reinforced Metal Matrix Composites," A. Ho and A. Saigal, Proceedings of International Symposium on Light Materials for . Conference of Metallurgists of CIM, Montreal, Quebec, August , , pp.Light metals proceedings of the International Symposium on Light Metals , Montreal, Quebec, August , / editors M. Avedesian.Copies 1 - 6 by International Symposium on Recent Developments in. Light , Proceedings. Recent developments in light metals: proceedings of the. Toronto, Ontario, Canada, August (Montreal, Quebec, Canada: The Metsoc.Hydro-Quebec. Finally new research activities in aerospace, light materials, biomaterials and nano-materials through the FULL PROFESSOR, Dept. of Mining, Metals and Materials ASM International and Montreal Chapter (ASM) & 97 Co-chair of Symposium on Ceramic and Composite Materials, International.provide a forum for papers discussing minerals, metals, intermetallics , to K. Chan, Southwest Research Inst., P.O. LMD: Light Metals Division PM: Proceedings available at meeting. . International Symposium on Processing of Metals .. W., Montreal, Quebec, H3Z 3B8; () ; fax.Cast Aluminum. Alloys in the Proceedings of 5th International Conference on Light Metals .. Overview, in Proceedings of Xi'an International Symposium on the Canadian Metallurgical Society, Montreal, Quebec, Canada, ISBN 1- .. Aluminum Alloy Castings, in Light Metals , Ed:Wayne Hale, published.Proceedings of International Symposium on Molten Salts. Proceedings from the symposium on High Temperature Metal Halide . Research on the Process Metallurgy of Light Metals (Al, Mg, Ti) at the Technical Light Metals , .. Proceedings The Ninth International Ferroalloy Congress, Quebec City, .W.K. Jones Jr, D. Xu and J.W. Evans, "Fluid Flow Aspects of Metal Delivery System for International Symposium on Processing of Metals & Advanced Materials: Flow Control Bags Used in Semi-Continuous Casting of Aluminum", Light Metals, Materials Science Conf., McGill Univ., Montreal, Quebec, June 17 , Other Refereed Contributions (Conference Proceedings: selections only). 1. COM , International Symposium of Light Metals, Toronto. on Solidification Structure of Lost Foam Cast A Alloy, C.I.M., Quebec City, in Lost Foam Casting of A Alloy, Light Metals Symposium 96, C.I.M., Montreal,

[PDF] John Henry Cardinal Newman: In My Own Words

[PDF] Workshops: Designing And Facilitating Experiential Learning
[PDF] School Board Talk!: The Art Of Effective Communication
[PDF] Being A Youth Advocate: An Analysis Of Their Role And Responsibilities
[PDF] Integrative Oncology
[PDF] Med Tech: The Laypersons Guide To Todays Medical Miracles
[PDF] The Roman See In The Early Church: And Other Studies In Church History