

Constituent Particle Break-up during Hot Rolling of AA 5182

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ABSTRACT

Aluminium sheet is currently used for body panels on a number of mass-produced vehicles, in particular for closure panels. AA5xxx alloys always contain coarse intermetallic particles ($\text{Al}_3(\text{Fe,Mn})\text{Si}$, Mg_2Si) after casting, undesirable for the final sheet forming and stamping operations. In the present work intermetallic particle break-up during hot reversible rolling of AA5182 alloy sheets has been analysed.

The sizes and shapes of intermetallic particles in as-cast and industrially hot rolled AA5182 alloys sheets were characterized by 3D X ray tomography observations. The relation between particle break-up and particle morphology was then analysed statistically and by a micromechanical finite element based model.

The essential outcomes of the statistical approach may be summarized as follows. The intermetallic particle population may be described by five morphological parameters (three parameters in the principal component space), allowing us to follow the evolution of inter-metallic particles during hot rolling. Secondly the comparison of the particle morphology in as cast and industrially rolled sheets leads to the definition of 5 classes. The evolution of each particle class as function of the rolling strain is provided. The statistical analysis shows *which* particles break-up.

The stresses and strains in inter-metallic particles, embedded in an elasto-viscoplastic aluminium matrix submitted to plane strain compression, were analysed by a finite element (FE) model. A new failure criterion for brittle pre-cracked solids embedded in a soft matrix submitted to large straining was proposed. The essential outcomes of the mechanical approach

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EPD Congress 2014 Yurko, Lifeng Zhang, Antoine Allanore, Cong Wang, Jeffrey S. Spangenberg, Randolph E. Kirchain, Jerome P. Downey, Lawrence D. May, 2014-01-09 EPD Congress is an annual collection of conference proceedings that addresses extraction and processing metallurgy The papers in this book are drawn from symposia held at the 2014 Annual Meeting of The Minerals Metals Materials Society The 2014 edition includes papers from the following four symposia Fluidization Technologies for the Mineral Materials and Energy Industries General Recycling Materials Processing Fundamentals Recycling and Sustainability Update EPD Congress 2003 , 2003 Remediating an integrated copper complex Past problems present issues **EPD Congress 2012** Lifeng Zhang, Joseph A. Pomykala, Arjan Ciftja, 2012-05-09 Proceedings symposia sponsored by the Extraction Processing Division EPD of The Minerals Metals Materials Society TMS Held during the TMS 2012 Annual Meeting Exhibition Orlando Florida USA March 11 15 2012 EPD Congress 2003 M. E. Schlesinger, 2003 The 14th edition in the EPD Congress series this volume is concerned with environmental issues reflecting the increased significance of this facet of metals production and processing A centerpiece of this volume is the proceedings on mercury management in metals production and recycling an area in which the breadth of expertise within TMS provides a unique opportunity for comprehensive examination of the topic *EPD Congress 2015* James Yurko, Antoine Allanore, Laura Bartlett, Jonghyun Lee, Lifeng Zhang, Gabriella Tranell, Yulia Meteleva-Fischer, Shadia Ikhmayies, Arief Budiman, Prabhat Tripathy, Guy Fredrickson, 2016-12-10 EPD Congress is an annual collection that addresses extraction and processing metallurgy The papers in this book are drawn from symposia held at the 2015 Annual Meeting of The Minerals Metals Materials Society The 2015 edition includes papers from the following symposia Materials Processing Fundamentals Solar Cell Silicon High Temperature Electrochemistry II **Resource Recovery and Recycling from Metallurgical Wastes** S.R. Ramachandra Rao, 2011-08-29 Resource recovery and recycling from millions of tons of wastes produced from industrial activities is a continuing challenge for environmental engineers and researchers Demand for conservation of resources reduction in the quantity of waste and sustainable development with environmental control has been growing in every part of the world Resource Recovery and Recycling from Metallurgical Wastes brings together the currently used techniques of waste processing and recycling their applications with practical examples and economic potentials of the processes Emphasis is on resource recovery by appropriate treatment and techniques Material on the subject is scattered in waste management and environmental related journals conference volumes and government departmental technical reports This work serves as a source book of information and as an educational technical reference for practicing scientists and engineers as well as for students Describes the currently used and potential techniques for the recovery of valuable resources from mineral and metallurgical wastes Discusses the applications to specific kinds of wastes with examples from current practices as well as the economics of the processes Presents recent and emerging technologies of potentials in metal recycling and by product

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William G I Davenport *Hydrometallurgy 2003* Courtney Young, 2003 Sponsored by The Extraction and Processing Division
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Vancouver BC Canada August 24 27 2003 *The Metrics of Material and Metal Ecology* M.A. Reuter, U.M.J. Boin, A van
Schaik, E. Verhoef, K. Heiskanen, Yongxiang Yang, G. Georgalli, 2005-11-02 This book is a must for individuals and companies
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aspects to quantify this System modelling of recycling systems with applications in the automotive and consumergoods sector

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Chemical Sensors Ghenadii Korotcenkov, 2013-06-26 Momentum Press is proud to bring to you *Chemical Sensors Simulation and Modeling Volume 5 Electrochemical Sensors* edited by Ghenadii Korotcenkov This is the fifth of a five volume comprehensive reference work that provides computer simulation and modeling techniques in various fields of chemical sensing The important applications for chemical sensing include such topics as bulk and surface diffusion adsorption surface reactions sintering conductivity mass transport and interphase interactions In this fifth volume you will find background and guidance on Modeling and simulation of electrochemical processes in both solid and liquid electrolytes including charge separation and transport gas diffusion ion diffusion in membranes proton electron transfers electrode reactions etc Various models used to describe electrochemical sensors such as potentiometric amperometric conductometric impedimetric and ionsensitive FET sensors Chemical sensors are integral to the automation of myriad industrial processes and everyday monitoring of such activities as public safety engine performance medical therapeutics and many more This five volume reference work serves as the perfect complement to Momentum Press's 6 volume reference work *Chemical Sensors Fundamentals of Sensing Materials and Chemical Sensors Comprehensive Sensor Technologies* which present detailed information related to materials technologies construction and application of various devices for chemical sensing

Aluminum Recycling Mark E. Schlesinger, 2013-12-21 What makes this book unique is a specific focus on aluminum recovery rather than just recycling in general It also offers an integrated discussion of scrap recovery and re melting operations and includes economic as well as technical elements of recycling Important topics include a discussion of the scrap aluminum marketplace and how secondary a

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Rare Metal Technology 2023 Takanari Ouchi, Kerstin Forsberg, Gisele Azimi, Shafiq Alam, Neale R.

Neelameggham, Hojong Kim, Alafara Abdullahi Baba, Hong Peng, Athanasios Karamalidis, 2023-02-10 This collection presents papers from a symposium on extraction of rare metals from primary and secondary materials and residues as well as rare

metals extraction processing techniques used in metal production The collection covers the extraction of less common or minor metals including elements such as antimony bismuth barium beryllium boron calcium chromium gallium germanium hafnium indium manganese molybdenum platinum group metals rare earth metals rhenium scandium selenium sodium strontium tantalum tellurium and tungsten It also includes rare metals of low tonnage sales compared to high tonnage metals iron copper nickel lead tin zinc or light metals such as aluminum magnesium or titanium and electronic metalloid silicon Rare metal processing covers bio metallurgy hydro metallurgy and electro metallurgy while novel high temperature processes such as microwave heating solar thermal reaction synthesis and cold crucible synthesis of rare metals are also addressed Also included in this collection is the design of extraction equipment used in these processes from suppliers as well as laboratory and pilot plant studies

Sulfuric Acid Manufacture Matt King, Michael Moats, William G. Davenport, Matthew J. King, 2005-11-04 More sulfuric acid is produced every year than any other chemical It has a wide range of uses including phosphate fertilizer production explosives glue wood preservatives and lead acid batteries It is also a particularly corrosive and dangerous acid with extreme environmental and health hazards if not manufactured used and regulated properly Sulfuric Acid Manufacture Analysis Control and Optimization keeps the important topics of safety and regulation at the forefront as it overviews and analyzes the process of sulfuric acid manufacture The first nine chapters focus on the chemical plant processes involved in industrial acidmaking with considerable data input from the authors industrial colleagues The last 15 chapters are dedicated to the mathematical analysis of acidmaking Both Authors bring years of hands on knowledge and experience to the work making it an exceptional reference for anyone involved in sulfuric acid research and or manufacture Only book to examine the processes of sulfuric acid manufacture from an industrial plant standpoint as well as mathematical Draws on the industrial connections of the authors through their years of hands on experience in sulfuric acid manufacture A considerable amount of industrial plant data is presented to support the text

Proceedings of the 15th International Conference on Environmental Degradation of Materials in Nuclear Power Systems - Water Reactors Gabriell Ilevbare, Jeremy Busby, Peter Andersen, 2017-07-17 This 15th Edition of the International Conference on Materials Degradation in Light Water Reactors focuses on subject areas critical to the safe and efficient running of nuclear reactor systems through the exchange and discussion of research results as well as field operating and management experience

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Arsenic Metallurgy Ramana G. Reddy, V. S. Ramachandran, 2005-02 Arsenic has long been a problem associated with the extraction of nonferrous metals During the last decade a combination of lower grade ores and environmental concerns has resulted in accelerated technological developments to meet arsenic challenges This volume presents the necessary technologies to further advance arsenic metallurgy Treatment of high arsenic containing ores

and metallurgical streams and wastes are given particular attention. Arsenic metallurgical reactions process and environmental technologies are also reviewed. From http://www.tms.org/Meetings/Annual/05/AnnMtg05Home.html#target_blank 2005 TMS Annual Meeting to be held in San Francisco February 13-17 2005 *Process Imaging For Automatic Control* David M. Scott, Hugh McCann, 2018-10-03 As industrial processes and their corresponding control models increase in complexity the data provided by traditional point sensors is no longer adequate to ensure product quality and cost effective operation. Process Imaging for Automatic Control demonstrates how in process imaging technologies surpass the limitations of traditional monitoring systems by providing real time multidimensional measurement and control data. Combined with suitable data extraction and control schemes such systems can optimize the performance of a wide variety of industrial processes. Contributed by leading international experts, Process Imaging for Automatic Control offers authoritative comprehensive coverage of this new area of process control technology including Basic goals of process modeling and their application to automatic control. Direct imaging devices and applications such as machine vision and spatial measurement of flow velocity pressure shear pH and temperature. Various techniques hardware implementations and image reconstruction methods for process tomography. Image enhancement and restoration. State estimation methods. State space control system models control strategies and implementation issues. Five chapters devoted to case studies and advanced applications. From theory to practical implementation this book is the first to treat the entire range of imaging techniques and their application to process control. Supplying broad coverage with more than 270 illustrations and nearly 700 cited references it presents an accessible introduction to this rapidly growing interdisciplinary technology. **Converter and Fire Refining Practices** Alistair G. Ross, Tony Warner, Ken Scholey, 2005-02 These proceedings will provide readers with an update on research development and operating practice in the fields of converting fire refining and casting in the base metal pyrometallurgy industry. Materials and supply vendors service providers and researchers and plant operators in the pyrometallurgy industry will find this book to be a valuable resource. From the http://www.tms.org/Meetings/Annual/05/AnnMtg05Home.html#target_blank 2005 TMS Annual Meeting held in San Francisco California February 13-17 2005

Solid Waste Management Ramesha Chandrappa, Diganta Bhusan Das, 2012-06-30 Solid waste was already a problem long before water and air pollution issues attracted public attention. Historically the problem associated with solid waste can be dated back to prehistoric days. Due to the invention of new products technologies and services the quantity and quality of the waste have changed over the years. Waste characteristics not only depend on income culture and geography but also on a society's economy and situations like disasters that affect that economy. There was tremendous industrial activity in Europe during the industrial revolution. The twentieth century is recognized as the American Century and the twenty first century is recognized as the Asian Century in which everyone wants to earn as much as possible. After Asia the currently developing Africa could next take the center stage. With transitions in their economies many countries have also witnessed an explosion

of waste quantities Solid waste problems and approaches to tackling them vary from country to country For example while efforts are made to collect and dispose hospital waste through separate mechanisms in India it is burnt together with municipal solid waste in Sweden While trans boundary movement of waste has been addressed in numerous international agreements it still reaches developing countries in many forms While thousands of people depend on waste for their livelihood throughout the world many others face problems due to poor waste management In this context solid waste has not remained an issue to be tackled by the local urban bodies alone It has become a subject of importance for engineers as well as doctors psychologist economists and climate scientists and any others There are huge changes in waste management in different parts of the world at different times in history To address these issues an effort has been made by the authors to combine their experience and bring together a new text book on the theory and practice of the subject covering the important relevant literature at the same time

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