Volume I Table of Contents

Extrusion/Die Practical Extrusion Equipment Extrusion/Die Theoretical

EXTRUSION/DIE PRACTICAL

The Dynamics of Dead Zones in Hot Extrusion

Christopher Jowett, Nick Parson, Raynauld Guay, Sebastien Fafard, Alexandre Maltais, Jean-Francois Beland

The Influence of Die Bearing Geometry on Surface Recrystallization of 6xxx Extrusions

Nick Parson, Alexandre Maltais, Chris Jowett

Tooling and Performance

Flow of Billet Surface Material During Extrusion of Al Alloys; Effect of Billet Quality and Process Conditions

Oddvin Reiso, Martin Lefstad, Jostein Røyset, Ulf Tundal

6005A: Practical Evidence of Advantages for Extruders and Their Customers

Jonathan Pangborn, Eskild Hoff, Richard Dickson, Chris Devadas

Improving the Wear and Extrusion Speed of Extrusion Tools with a Unique Duplex Surface Treatment

Ray Reynoldson

Developments in Hot Work Tool Steels: Looking Beyond the Basics toward True Savings in Aluminum Extrusion Tooling

Patricia Miller, Danny Capo, Bengt Klarenfjord, Franz Russ

Development of a New Aluminum Extrusion Hot Work Tool Steel

Jose Bacalhau, Celso Antonio Barbosa, Patricia A. Miller

Increased Productivity using CVD-Coated Insert Tooling

Nick Nolting, Gary W. Dion, Kelby Graham

Dies, Inserts, and Coatings

Die Heating Excellence and Energy Savings

Dirk Menzler, Fredrik Berge

Dies Digital Archive and Remote Correction System; Time and Cost Savings for Correction Departments

Nicola Cividini, Tommaso Pinter, Diana Tedoldi

Optimal Die Prefill Practices for Soft Alloy Extrusion

Rob Palmer, Palitha Abeyasinghe

Weldability Testing of Hard Deformable Aluminum Alloys Intended for Extrusion through Porthole Dies

Dariusz Lesniak, Jan Richert, Wojciech Libura, Marcin Mroczkowski, Jakub Sobota

Hot Extrusion of AI/SiC Powder through Porthole Die

Artur Rekas, Jozef Zasadzinski, Jan Richert, Wojciech Libura, Dariusz Lesniak

A Study of Multi-material Die Insert Failure Mechanism in Aluminum Extrusion

Pawel Kazanowski

Tribological Investigation on CVD-Coated Extrusion Dies

Joachim Maier

Best Practices

Helping the Customer - Part Two

Ram Ramanan, Jerome Fourmann, Nick Parson, Chris Jowett

Significant Extrusion Speed Increase Using Liquid Nitrogen to Eliminate Overheating of Dies during Extrusion Process

Enea Mainetti, Massimo Bertoletti, Shmaya Wallfish, Antonio Ferrentino

Simple Temperature Measurement Techniques for Extruders: Straightforward Solutions in a Tough Market

Jonathon Pangborn, Mark Rokos, Joan Mammen, Eskild Hoff, Richard Dickson

Hard Alloys

Development and Application of New AA2013 Alloy

Katsuya Kato, Tadashi Minoda, Hideo Sano

Extrusion of Hard-Alloy, Thin-Wall Hollow Profiles

Frank F. Kraft

New Developments in Extrusion of 2xxx Alloys with Solution Heat Treatment on the Press

Dariusz Lesniak, Józef Zasadzinski, Marek Galanty, Antoni Woznicki, Artur Rekas

EXTRUSION EQUIPMENT

Heavy Duty Extrusion Presses for Large Profile Applications

Axel Bauer

For Large Profiles

Nondestructive Examination of Extrusion Press Hydraulic Cylinder Pressure Walls

Ronald P. Manganello

Large Press Handling Systems

David R. Jenista

Extrusion Equipment Dedicated to Large Profile Press Line

Giulia Bertoli

Safety and Automation

Extrusion Press Safety from a Hydraulic System Design Perspective

Steve D. DeMar

A New Extrusion Press Concept

Paolo Fraternale

Evaluation of Process Mechanism and Parameters for Automated Stretching Line

Pawel Kazanowski, Richard Dickson

Extruder Automation Comes of Age: A Review and Outlook of Automation Systems for Aluminum Extruders

Madhukar Pandit, Christian Schwarz

Dummy Block Lubrication Best Practices

James E. Dyla

Container and Tooling

Interactions between Mechanical and Thermal Stresses in Extrusion Containers

Gernot Strehl

New Materials and Intelligent Design on Extrusion Tooling

Werner Haehnel, Klaus Gillmeister

Die Heating and Preparation

Phase-Controlled Nitriding and Nitrocarburizing Applied to Reduce Flaking, Brittleness, and Improve Die Life

Jack A. Kalucki

Die Cleaning and Polishing Production Experience

Craig S. Johnson, Jim Gale

Innovative Integrated Plants of Die-Cleaning and Caustic Soda Recovery: Case History of a Big and Modern European Plant

Walter Dalla Barba, Fabio Vincenzi, Federico Vincenzi, Marcello Rossi

Efficiencies

Can Automated Die-Polishing Help Your Extrusion Output and Efficiency?

John Stackhouse

Improving Recovery with Rotary Log Welding

David R. Jenista

Efficiency Optimization of the Aluminium Extrusion Plants

Giulia Bertoli, Carsten Dede

Gas-Induction Inline Oven

Uwe Günter, Stefan Beer

EXTRUSION/DIE THEORETICAL

Surface Pick-up Formation: New Limits in the Limit Diagram

Andrew J. den Bakker, Xiao Ma, Matthijn De Rooij, Robert J. Werkhoven

Friction and Pickup

Analyzing the Tribological Phenomena in Hot Extrusion Processes by Using New Torsion-Tribo Test

Pavel Hora, Maysam Gorji, Joachim Maier

Determination of Friction Behavior in Extrusion Processes with a New Experimental Method

Dong-Zhi Sun, Andreas Kailer, Florence Andrieux, Andrea Ockewitz

Benchmark, Finite-Element Method, Metal Flow

A Review on FEM Codes Accuracy for Reliable Extrusion Process Analysis: the Extrusion Benchmark 2009 and 2011

Lorenzo Donati, Nooman Ben Khalifa, Luca Tomesani, Erman A. Tekkaya

Study of Effects of Variations in Process Parameters on the Extrusion Process by Use of Finite– Element Simulations

Amin Farjad Bastani, Trond Aukrust, Sverre Brandal

Application of Numerical Simulation Technology to Optimize Die Designs for the Production of Complex Aluminum Profiles

Xiang Sheng-qian, Cheng Lei, Xie Shui-sheng, Zhou Chunrong, Cai Yue-hua, He Youfeng

Constitutive Equations for Hot Extrusion of AA6005A, AA6063 and AA7020 Alloys

Tommaso Pinter, Mohamad el Mehtedi

The State of the Art in Aluminum Extrusion Simulation Using the Finite Element Method

John Walters, Mike Foster, Alexander Bandar

Weld and Finite-Element Method

Prediction of Position and Extent of Charge Welds in Hollow Profiles Extrusion

Antonio Segatori, Barbara Reggiani, Lorenzo Donati, Luca Tomesani

Practical Approach to Computer Simulation and Optimization of Complex Thin Profile Extrusion Nikolay Biba, Andrey Lishny, Sergey Stebunov

Metal Flow Analysis in a Complex Die

Andrew J. den Bakker, Robert J. Werkhoven

Modeling, Microstructure and Simulation

Development of a Numerical Method for Simulation of Aluminum Extrusion Processes with Modeling of Microstructure

Andrea Ockewitz, Dong-Zhi Sun, Florence Andrieux, Soeren Mueller

Modeling the Extrusion Process and the Microstructure Evolution for Hot Extrusion of AA3xxx

Aluminum Alloys

Yahya Mahmoodkhani, Mary A. Wells, Nick Parson, Lina Grajales, Warren J. Poole

Investigation of the Dynamic Grain Structure Evolution during Hot Extrusion of EN AW-6082

Ahmet Güzel, Andreas Jäger, Nooman Ben Khalifa, A. Erman Tekkaya

Through Process Modeling (TPM) of Grain Structure Evolution in 6xxx Series Aluminium Extrusions

Ole Runar Myhr, Trond Furu, Ole Johannes Emmerhoff, Inge Skauvik, Olaf Engler

Deformation Prediction of Porthole Dies after Multiple Extrusion Cycles

Barbara Reggiani, Lorenzo Donati, Luca Tomesani

Distortion Mechanisms due to the Cooling Process in Aluminum Extrusion

Saeed Bikass, Bjørn Andersson, Artem Pilipenko, Xiang Ma

Functional Data Analyses in Control of Extrusion Process

Igor Duplancic, Branimir Lela, Ante Musa, Oliver Zovko

Composites and Nonconventional Materials

Influence of the Steel-Reinforcement Geometry on Position and Embedding Quality in Discontinuously-Reinforced, Co-Extruded Aluminum Profiles

Annika Foydl, Emrah Turan, Andreas Jäger, A. Erman Tekkaya

Extrusion of Ingot and Powder Metallurgy Aluminum Matrix Composites Profiles

Marcela Lieblich, Pilar Rey, Gaspar González-Doncel, Alfonso Vázquez, Joaquín Ibáñez, Gemma Castro, Ricardo Fernández, Virginia Vadillo

Simulation-Aided Design of Porthole Dies for Magnesium Alloys Extrusion

Tommaso Pinter, Yoram Rami, Tuvia Kornfeld, Antonio Segatori, Lorenzo Donati, Luca Tomesani

Volume II Table of Contents

Billet Process & Equipment Management Issues Value-Added Processes

BILLET PROCESS & EQUIPMENT

The Influence of Iron Content on the Tensile Properties and Anodizing Response of AA6060 Extrusions

Lisa Sweet, Xinquan Zhang, Nick Birbilis Birbilis, Mark A Easton

Alloys

Influence of Varying the Chemical Composition on the Extrusion Performance of AA6060 and AA6063 Alloys

Leonel Batalla, Fernando L. Daroqui, Eduardo Siri, María V. Canullo

High Speed Alloys: On the Optimization of 6xxx Alloys for Medium Strength Requirements

Ulf H. Tundal, Oddvin Reiso, Eskild Hoff, Richard Dickson, Chris Devadas

Influence of Fe and Mn Content on 6xxx Extrusion Alloys

Malcolm J Couper, Elizabeth D Sweet, Xinquan Zhang

Composition Analysis Uncertainty: Impact, Common Causes and Use of Production Limit Offsets to Ensure On-Composition Product

Keith K. Trischan, Michael L. Ruschak, Jay H. Goodman, Rebecca K. Wyss, Michael K. Brandt

Effect of a New Solution and Aging Treatment on the Microstructure and Tensile Properties of the H755 Aluminum Alloy

Jianxiang Li, Zhibing Yang, Zhimin Yin

High Performance AA6063 Designed to Meet 6xxx Medium Strength Alloy Properties

Jerome Fourmann, Ram Ramanan, Nick Parson

Casting, Casthouse, Environmental Health & Safety

Large Diameter Billet Casting Technology

Tim Scott

Effects of Different Lubricating Oils and Ceramic Ring Overhang (CRO) on the Surface Appearance of 6xxx series Alloy Billets

Ricardo Sammy, Kedar Tilak

Transient Molten Metal Quality at the Start and End of DC Casting and the Impact on Extrusion Phil Enright

Molten Metal Safety in Aluminum DC Billet Casting

James A. Brock, Jake J. Niedling, C. Wayne Shanko

Reducing Environmental Impacts in the Casthouse

Corleen Chesonis, Gregg E. Kruzynski, David H. DeYoung

Minimizing Production Shutdowns through Effective Application and Maintenance of Safety Pit Coatings

Alex Lowery, George Stavnes

Homogenization

Homogenization Aspects, Continuous versus Batch in an Integrated Modern Casthouse

Franz Niedermair

A New Method to Control Load Temperature in Batch Homogenization Process

André Larouche, Matthew Gavin, Claude Carrier

Homogenization of AI-Mg-Si Alloy Billets – Myths and Facts

Jostein Røyset, Øystein Bauger, Jan Anders Sæter, Ulf Tundal, Oddvin Reiso

MANAGEMENT ISSUES

Is Operational Modeling Worth the Effort? Using Simple Spreadsheet Models of Extrusion Operations to to Ask "What if"? Questions Regarding Equipment and Profiles

Craig R. Werner

Operations

Six Sigma Methodology Analysis Applied to Extrusion Plant

Rodrigo C. Campana

The Practical Application of Advanced Linear Programming Modeling Techniques to Optimize Extrusion Operations

Craig R. Werner

Flow Stress and Knowledge-Based Superextruders

Paul Robbins

Down Time Monitoring & Extrusion Process Monitoring

Markus Dobler

Extrusion Process Equipment Upkeep for Better Plant Performance -- "Mission 95"

Rajat Agarwal, Prasanna B. Venkatesha

How Data Integrity can be Used as a Simple, Effective Means to Continuously Improve Extrusion Results

Craig R. Werner

Using Data to Calculate Optimized Log Lengths and Mill Lengths in an Aluminum Extrusion Operation – A Case Study

Craig R. Werner

Search For Similar Profiles through Pattern Matching Algorithms: Effectiveness and Advantages for Extrusion Companies

Alain Michalak, Marco Azzalin, Stefano Bellotti, Vincenzo Giacomelli

Employee Motivation in an Aluminum Extrusion Operation

Craig R. Werner, James H. Scheuing

Markets and Applications

Aluminum Consumption and Aluminum Extrusion Industry in China

Zitao Wang, Jingru Liu

Leveraging the Design Advantages of Aluminum Extrusions vs. Competitive Materials - How the Aluminum Extrusion Industry can Expand its Markets

Craig R. Werner, Nicholas Palladino, John Funai, Randy Kissell, Rob Nelson

Global Aluminium Applications in Electric Vehicles and Charging Infrastructure

Roberto Boeker

Economics of Aluminum Extrusion for Aerospace Applications

Pradip K. Saha

Die-Related

Optimization of Die Wear and Tear for 6063 Alloy

Modar Al Mekdad, Sutanay Parida, Suresh Annadurai

Improvements in Aluminum Extrusion Profitability through Competence

Mike S. Warkins, Jon E. Veenstra

Sustainability and Recycling

Constructing the Sustainable Path Forward

Patrick M. Muessig

The Effect of Die Design on the Mechanical Properties of Profiles Recycled From AA6060 Chips by Hot Extrusion

Volkan Güley, Andreas Jäger, A. Erman Tekkaya

Trivalent Chromium: A "Green" Solution to Hexavalent Chromium

Harry F. Adams

Green and Smart Anodizing: The Anodizing of the Future Available Today

Walter Dalla Barba, Fabio Vincenzi, Federico Vincenzi, Marcello Rossi

Aspects of Preferential Grain Etching During Alkaline Pre-Etching Step Before Anodizing of Aluminium Profiles.

Øystein Bauger, Hans Bjerkaas

VALUE-ADDED PROCESSES

Trace Elements and their Impact on the Surface Finishing Characteristics of Aluminum Extrusions

Jude Mary Runge

Metallurgical Factors

Factors Affecting the Machinability of Al-Mg-Si Extrusions

Imed Zaghbani, Victor Songmene, Jules Kouam, Nick Parson, Alexandre Maltais

Metallurgical Analysis of Surface Streaking Defect in AA6060 Extrudate

Andrew J. Thome, Joshua E. Walker, Timotius Pasang, Wojciech Z. Misiolek

Solar

Aluminum in Solar: Manufacturing Cost Analysis of CSP Structures

Anthony E. Mascarin, Ted A. Hannibal

Issues on the Design and Fabrication of Extruded Aluminum Framing for the Solar Industry Giovanni Barbareschi

Process Improvements

Stretch Wrapping of Master Bundles and Wooden Battens Raffaele D'Andrea, Carsten Dede

Randele D'Andrea, Carsten Deue

New Developments in Extrusion of Profiles with Variable Curvatures and Cross-Sections Alessandro Selvaggio, Sami Chatti, Nooman Ben Khalifa, A. Erman Tekkaya

A New Liberalization Trend in the Aluminum Fenestration Industry

Giovanni Barbareschi

Finishing

The XS Plant: The Vertical Line for Window Makers

Carlo Zucchetti

Advanced Decoration Technology for Aluminum

Enrico Piva

The World Highest Vertical Powder Coating Line for Aluminium Profiles

Carlo Zucchetti

Acid Etching for Extruded Aluminium: Technical, Economical and Environmental Aspects

Alberto Fuentes

Design Developments

Innovative Extrusions for Value-Added Applications

Mario Conserva, Alberto Pomari

Developments in the Design of Aluminum Extrusions for Structural Applications

J. Randolph Kissell, Michael H. Skillingberg

Review of Past Innovations and Recent Improvements in Aluminum Extrusion Production: from Alloy to Process Development

Joseph C. Benedyk