Eleventh International Symposium on Bearing Steel Technologies: Progress in Steel Technologies and Bearing Steel Quality Assurance

Sponsored by ASTM Committee A01 on Steel, Stainless and Related Alloys

November 16-18, 2016
Renaissance Orlando at Sea World
Orlando, Florida, USA

Symposium Chairman: John Beswick
Montfoort
The Netherlands

Chairman Subcommittee A01.28: Pat McDonough
Gerdau Special Steel North America

TUESDAY NOVEMBER 15, 2016

5:00 PM to 6:30 PM WELCOME RECEPTION
WEDNESDAY NOVEMBER 16, 2016

8:00 AM
Opening Remarks, Award Presentation and Symposium Introduction
Pat McDonough, Gerdau Special Steel North America, Fort Smith, AR, USA
and John Beswick, Montfoort, The Netherlands

Session 1: Advances in Bearing Steel “Clean Steel”
Steelmaking and Processing

Session Chair: Pat McDonough
Gerdau Special Steel North America
Fort Smith, AR, USA

8:30 AM
Steel Quality Improvements with Vertical Continuous Casting at Faircrest Steel Plant
C. Eastman Jr., TimkenSteel Corporation, Canton OH, USA

9:00 AM
Research & Development and Quality Assurance of Large Size Round Blooms for Bearing
X. Xiaohong, L. Jigang W. Pen and C. Ru, XingCheng Special Steel, Binjiang Jiangyin, PR China

9:30 AM
Advantages of Si-deoxidation of Bearing Steels for the Steel Cleanliness and for the Composition and Morphology of Non-metallic Inclusions in the Rolled Product
D. Ladutkin, E. Korte, M. Bleymehl, C. Bruch and K.-G. Doppler, Voelklingen, Saarstahl AG, Germany

10:00 AM Break

10:30 AM
Combined Al-Si-Ca Treatment of EAF-VD Steel
K. Riyahi Malayeri, Scana Energy AB, Björneborg, Sweden

11:00 AM
In-depth Comparison of Powder and Ingot Metallurgical M50 Bearing Steels
G. Guetard and P. Rivera-Díaz-del Castillo, University of Cambridge, Cambridge, United Kingdom; J. André, Erasteel Kloster AB, Söderfors, Sweden; J. Bellus, Aubert & Duval, Les Ancizes-Comps, France; and M. Y. Sherif, SKF Engineering & Research Centre, MT Nieuwegein, The Netherlands
Session 2: Advances in Rolling Contact Modelling, Functional Life Prediction Rolling Contact Testing

Session Chair: Phil Predmesky
SKF North American Technical Centre
Plymouth MI, USA

11:30 AM
Microstructural Changes in Aerospace Bearing Materials under Accelerated Rolling Contact Fatigue Life Testing
M. Kirsch, Air Force Research Laboratory Wright Patterson AFB, OH, USA;
H. Trivedi, UES Inc. Dayton OH USA; and D. James, UDRI, Dayton, OH, USA

12:00 PM
RCF Performances Using a Discriminating Multi-contact Test

12:30 PM Lunch

1:30 PM
Influence of Material and Heat treatment on the Formation of WECs on Test Rig FE8
T. Blass, W. Trojahn and D. Merk Schaeffler Technologies, Schweinfurt, Bavaria, Germany

2:00 PM
Applying Finite Element Analysis to Determine the Subsurface Stress and Temperature Gradient in Highly Loaded Bearing Contacts

2:30 PM
Improved Fatigue Life Analysis of Pre-dented Raceways Used in Bearing Material Testing
A. Gabelli SKF Engineering and Research Centre, Nieuwegein, The Netherlands; and G. E. Morales Espeje, Université de Lyon, INSA-Lyon, CNRS, LaMCoS France

3:00 PM Break
Session 3: Steel Alloy - Heat Treatments Relationships

Session Chair: Jim Carosiello
The TimkenSteel Corporation
Canton OH, USA

3:30 PM
Induction Hardening for Bearings Applications - A Review
W. Datchary and M. Wendel AB SKF, Gothenburg, Sweden

4:00 PM
The Influence of Si in High Carbon Bearing Steels
T. Sourmail and M. Millot-Méheux, Asco Industries CREAS, Hagondange, France

4:30 PM
Spheroidising-annealing of High Hardenability Bearing Steel
M. Sherif and H. Huang, SKF, Nieuwegein, The Netherlands

5:00 PM
Influence of Silicon on the Cementite Spheroidization and the Role of Spheroidized Carbides on the Fatigue Life of 100Cr6 Bearing Steel
K. Kim and J. Yoo, POSCO Technical Research Laboratories, Goedong-dong Nam-gu, Pohang Gyeongbuk, South Korea

6:00 PM to 7:30 PM
RECEPTION

THURSDAY NOVEMBER 17, 2016

Session 4: New Steel Technologies for High Demanding Rolling Bearing Applications

Session Chair: Jeff Fuller
Amsted Rail
Petersburg, VA, USA

8:00 AM
Use of Powder Metallurgy Steels for High Reliability Bearings
C. Siddoroff, E. Lefort, Pierre Dierickx, NTN-SNR Roulements, Annecy, France
8:30 AM
**New Class of High Speed Steels for Aero Rolling Bearings**

9:00 AM
**Fatigue Life Performance of Hybrid Angular Contact Pyrowear 675 Bearings**
H. Trivedi and D. T. Gerardi, UES Inc. Dayton OH, USA; G. D. Givan and L. Rosado Air Force Research Laboratory, Wright Patterson AFB, OH, USA; and B. McCoy, SKF Aeroengine, Falconer, NY, USA

9:30 AM
**A New Approach for the Development of a Corrosion Resistant Martensitic Steel for the Application in Aerospace Bearing Applications**
S. Peissl, Leoben University, Kapfenberg, Austria; G. Morh, Co KG, Kapfenberg, Austria; and R. Fluch, H. Leitner, S. Egläsäer, Böhler Edelstahl GmbH, Austria

10:00 AM  **Break**

10:30 AM
**Novel Tough Micro-alloyed Bearing Steel with High Hardenability**

11:00 AM
**Improvement of Surface Originated Flaking Life of Carburized steel under Rolling Contact Fatigue Condition with Sliding Contact by the Modification of Subsurface Microstructure**
T. Maruyama, T. Fujimatsu and N. Tsunekage, Sanyo Special Steel Co., Ltd., Himeji-Shi,Hyogo, Japan

11:30 AM
**High Performance Bearing Steels: A New Approach in Alloy Development**
B. Clausen, T. Karsch and H.-W. Zoch, Stiftung Institut fur Werkstofftechnik, Bremen, Germany

12:00 PM  **Lunch**
Continuation of Session 4: 
New Steel Technologies for High Demanding Rolling Bearing Applications

1:30 PM  
PVD Coatings on Bearing Steels for Aerospace Applications  
H. Kukla, D. Müller and M. Lartz, Eifeler Werkzeuge GmbH, Schnaittach, Germany

2:00 PM  
Characterization of Bearing Steels for Elevated Temperature Applications  
M. Sherif and A. Kerrigan, SKF Engineering and Research Centre, Nieuwegein, The Netherlands

Session 5: Improved Methodologies for Bearing Steels Quality Assurance

Session Chair:  
Aidan Kerrigan  
SKF Engineering & Research Centre  
Nieuwegein  
The Netherlands

2:30 PM  
Prospective Study to Determine Possible Correlation between Rolling Contact Fatigue and Currently Common Cleanliness Evaluation Methods and Submerged Ultrasonic Testing  
S. Nazarenus, Deutsche Edelstahlwerke, Siegen, Germany

3:00 PM  
Relationship between Hot Workability and Centre Segregation in Bearing Steel  
X. Liu, SKF Automotive Market, Factory Lüchow, Lüchow, Germany;  
S. Kim, SeAH Besteel Corp., Gunshan, Korea; and A. Kerrigan,  
SKF Engineering & Research Center, Nieuwegein, The Netherlands

3:30 PM  
Break

4:00 PM  
Application of the OES-PDA Measurements to Predict the Macro-Cleanliness of Products Coming from Continuous casting Machine  
B. Krebs, N. Brun and G. Gremeaux, ABS Centre Métallurgique (ACM), Metz, France;  
A. Spadaccini, ABS (Acciaierie Bertoli Safau), Pozzuolo del Friuli (UD), Italia
4:30 PM
**Bearing Steel Quality Assurance with Next Generation SEM-EDS**
B. Ricker and V. Patel, FEI, Hillsboro, Oregon USA; and Kai van Beek, FEI, Bruno, Czech Republic

5:00 PM
**Advances in Rolling Bearing Component Metallurgical Quality Control Using Electromagnetic Non-Destructive Testing**
B. Droschak and T. Nilsson, Foerster Instruments Incorporated, Pittsburgh, PA, USA

6:00 PM to 7:30 PM  **Reception**

**FRIDAY NOVEMBER 18, 2016**

**Continuation of Session 5: Improved Methodologies for Bearing Steels Quality Assurance**

8:00 AM
**Round Robin Test - Chemical Analysis Capability of the Steel Material Laboratories**
M. Rubart, Siemens AG, Bocholt, Germany

8:30 AM
**Electrochemical Corrosion Test Methods for Rapid Assessment of Bearing Steel Performance**
M. Hurley, A. Kvryan, E. Faulkner, D. Lysne, S. Acharya, V. Rafla, Boise State University, Boise Idaho, USA; and H. K. Trivedi, UES Inc. Dayton, Ohio, USA

**Session 6: Advances in Non-Metallic Inclusion Knowledge**

Session Chair: John M. Beswick
Montfoort
The Netherlands

9:00 AM
**The Study of the Evaluation of the Fracture Initiation and Propagation on the Rolling Contact Fatigue in Bearing Steels**
A. Owaki, M. Shimamoto, and T. Sugimura Kobe Steel, Ltd., Nada-ku, Kobe, Hyogo, Japan; and K. Iwasaki, Kobe Steel, Ltd., Tokyo, Japan
9:30 AM
**Effect of Non-metallic Inclusions on Bending Fatigue Performance in High Strength Steels**
P. Glaws and M. Burnett, TimkenSteel Corporation, Canton, Ohio, USA

10:00 AM
**Non-Metallic Inclusion Bonding in Bearing Steel and the Initiation of White-Etching Cracks**
E. Vegter, H. Krock, and Y. Kadin, SKF Engineering Research Centre, Nieuwegein, The Netherlands; V. Ocelik, Rijksuniversiteit Groningen, Groningen, The Netherlands

10:30 AM
John M. Beswick, Symposium Chairman

10:45 AM  **Symposium Adjourns**