

STP 1419

Bearing Steel Technology

John M. Beswick, editor

ASTM Stock Number: STP1419



ASTM
100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA 19428-2959

Printed in the U.S.A.

Contents

Overview	vii
BEARING STEEL PROCESS DEVELOPMENTS	
Development of 5280 Rolling Bearing Steel for Improved Performance and Productivity—P. V. DIMITRY, P. M. MACDONOUGH, G. BECK, R. EBERHARD, AND H.-W. ZOCK	3
Effect of Steel Making and Processing Parameters on Carbide Banding in Commercially Produced ASTM A-295 52100 Bearing Steel—P. K. ADISHESHA	27
Ultra Clean Steel for Anti-Friction Bearing Applications—S. GANGULY, I. CHAKRABARTI, M. D. MAHESHWARI, AND T. MUKHERJEE	47
STEEL TECHNOLOGY AND BEARING COMPONENT MANUFACTURE	
Machinability Control—A Topic of Great Importance to the Engineering Industry—T. JOHANSSON AND H. SANDQVIST	71
Environmentally Friendly Bearing Steel With Reduced Hardening Distortion—T. B. LUND AND L. J. PATRIK ÖLUND	86
DEVELOPMENTS IN BEARING STEEL QUALITY ASSESSMENT AND CORRELATIONS WITH BEARING LIFE	
Appropriate Techniques for Internal Cleanliness Assessment—G. AUCLAIR AND P. DAGUIER	101
Influence of Hydrogen Trapped by Inclusions on Fatigue Strength of Bearing Steel—Y. MURAKAMI AND N. N. YOKOYAMA	113
Statistical Prediction of the Maximum Inclusion Size in Bearing Steels—G. SHI, H. V. ATKINSON, C. M. SELLARS, C. W. ANDERSON, AND J. R. YATES	125
Steel Supplier Evaluation Techniques to Assure Bearing Performance—J. O. WOLFE	138

Study of Evaluating Method for Non-Metallic Inclusions and Development of Slag Refining for Bearing Steel —T. NISHIKAWA, H. NAGAYAMA, S. NISHIMON, K. ASAI, I. FUJII, AND T. SUGIMOTO	148
Higher Macro-Cleanliness of Bearing Steels Needs More Accurate Measuring-Methods —D. THIERY AND C. DELHAES	164
Recent Evaluation Procedures of Nonmetallic Inclusions in Bearing Steels (Statistics of Extreme Value Method and Development of Higher Frequency Ultrasonic Testing Method) —Y. KATO, K. SATO, K. HIRAOKA, AND Y. NURI	176
DEVELOPMENTS IN BEARING SERVICE LIFE TESTING	
A New Physically Based Model for Predicting the Fatigue Life Distribution of Rolling Bearings —R. FOUÈRES, G. LORMAND, A. VINCENT, D. NELIAS, G. DUDRAGNE, D. GIRODIN, G. BAUDRY, AND P. DAGUIER	197
Estimation of Rolling Bearing Life Under Contaminated Lubrication —H. TANAKA AND N. TSUSHIMA	213
Rolling Contact Fatigue Under Water-Infiltrated Lubrication —Y. MATSUMOTO, Y. MURAKAMI, AND M. OOHORI	226
Microstructural Optimisation of Bearing Steels for Operation Under Contaminated Lubrication by Using the Experimental Method of Dented Surfaces —H.-J. BÖHMER AND R. EBERHARD	244
Rolling Contact Fatigue Tests to Investigate Surface Initiated Damage and Tolerance to Surface Dents —D. GIRODIN, F. VILLE, R. GUERS, AND G. DUDRAGNE	263
BEARING METALLURGY DEVELOPMENTS FOR IMPROVED SERVICE LIFE	
Development of Long Life Rolling Bearings for Use in the Extreme Conditions —M. SHIBATA, M. GOTO, A. OHTA, AND K. TODA	285
The Effect of V, Al and N on the Fatigue Life of a Carbonitrided Bearings —S. J. YOO, S. W. CHOI, S. K. HAN, J. S. LEE, B. J. JUNG, B. H. SONG, AND C. N. PARK	297
Development of a New Material for Guide Roll Bearings for Continuous Casting Machine —K. YAMAMURA AND M. OOHORI	309
Improved Bearing Steel for Applications Involving Debris, Higher Loads and Temperatures —P. DAGUIER, G. BAUDRY, J. BELLUS, G. AUCLAIR, J. ROFÈS-VERNIS, G. DUDRAGNE, D. GIRODIN, AND G. JACOB	320
The Effect of Bearing Steel Composition and Microstructure on Debris Dented Rolling Element Bearing Performance —D. CARLSON, R. PITSKO, A. J. CHIDESTER, AND J. R. IMUNDO	330

DEVELOPMENTS IN HIGH ALLOY STEEL FOR IMPROVED HIGH TEMPERATURE AND ENHANCED
CORROSION RESISTANCE PROPERTIES

Wear and Corrosion Resistant PM Tool Steels for Advanced Bearing Application— A. KAJINIC, R. B. DIXON, AND B. A. HANN	349
A Comparison of the Mechanical and Physical Properties of Contemporary and New Alloys for Aerospace Bearing Applications— M. A. RAGEN, D. L. ANTHONY, AND R. F. SPITZER	362
Progress in the Evaluation of CSS-42L™: A High Performance Bearing Alloy— C. M. TOMASELLO, H. I. BURRIER, R. A. KNEPPER, S. BALLIETT, AND J. L. MALONEY	375
Duplex Hardening for Aerospace Bearing Steels— E. STREIT AND W. TROJAHN	386
Carburizable High Speed Steel Alloys— D. W. HETZNER	399
The Development of Bearing Steels with Long Life and High Corrosion Resistance— S. TANAKA, K. YAMAMURA, AND M. OOHORI	414

MICROSTRUCTURAL CHANGE AND ITS RELATIONSHIP WITH BEARING FATIGUE AND
LIFE TIME PREDICTION

Local Elasto-Plastic Properties of Bearing Steels Determined by Nano-Indentation Measurements— A. VINCENT, H. ELGHAZAL, G. LORMAND, A. HAMEL, AND D. GIRODIN	427
Microstructural Stability and Bearing Performance— A. P. VOSKAMP	443

MATERIAL FACTORS IN BEARING LIFE CALCULATIONS

A Physically Based Endurance Limit Model for Through Hardened and Surface Hardened Bearing Steels— A. VINCENT, R. FOUGÉRES, G. LORMAND, G. DUDRAGNE, AND D. GIRODIN	459
Fatigue Limit Stress—A New and Superior Criterion for Life Rating of Rolling Bearing Materials— T. A. HARRIS	474
Application of a New Physically Based Model to Determine the Influence of Inclusion Population and Loading Conditions on the Distribution of Bearing Lives— G. LORMAND, D. PIOT, A. VINCENT, G. BAUDRY, P. DAGUIER, D. GIRODIN, AND G. DUDRAGNE	493
Rolling Bearing Material Quality Fatigue Testing—Material Quality Life Factors— A. GABELLI, S. IOANNIDES, J. BESWICK, G. DE WIT, H. KROCK, B. KORENHOF, AND A. KERRIGAN	509
Author Index	527
Subject Index	529