## **Table of Contents**

## **Preface**

## **Chapter 1: Lubricants and Surface Treatment for Tribological Properties Improvements**

New Developments in Phosphate Free Lubrication F. Hollmann and Y.F. Shi	3
Frictional Properties of Element- and Compound-Doped Diamond-Like Carbon Films under Boundary Lubrication with Synthetic Base Oil H. Okubo and S. Sasaki	13
Tribological Performance of Crosshatch Pattern Textured and Heat Treated Dual Engineered Ti6Al4V Surface under Bio-Lubricated Line Contact Configuration V. Kashyap and P. Ramkumar	21
Chapter 2: Tribological Aspects of Machining Processes	
Tribological Considerations when Modelling Tool Wear in Turning of 15-5PH Stainless Steel	
G. Methon, C. Courbon, R. M'Saoubi, M. Girinon and J. Rech	33
Test of a New Water-Based Lubricant in Turning of 316L Stainless Steel F. Rahn, A. Gilbin, M. Fontaine, X. Roizard, J.M. Melot and F. Lallemand	39
Surface Texturing in Cutting with Micro-Scale Structured Tools R. Uchiyama, F. Uchiyama, T. Kusumoto and T. Matsumura	45
Influence of Metal Working Fluids in Cutting Processes F. Pape, H.C. Liu, L. Ellersiek, A. Krödel, B. Denkena and G. Poll	51
Increasing and Decreasing Depth Taper Scratching: Force Response of Silicon C. Alreja and S. Subbiah	59
Chapter 3: Tribological Aspects of Sheet Metal Forming Processes	
Tribological and Thermal Behavior of Laser Implanted Tool Surfaces for Hot Stamping AlSi Coated 22MnB5 Sheets S. Schirdewahn, F. Spranger, K. Hilgenberg and M. Merklein	69
Characterization of an Environmentally Friendly Tribological System for Deep Drawing Using Volatile Media as Lubricant Substitute G. Reichardt and M. Liewald	75
An Investigation into the Influence of Interrupted Loading in Improving the Stretch-Flangeability of Dual Phase Steel	
K. Prasad, H. Krisnaswamy, D. Banerjee and U. Chakkingal  Optimization of the Surface Geometry in Structured Cold Rolling for Interlocking of	81
Formed and Die-Cast Metal Components A. Ringel and J. Lohmar	89
Challenges in Tribometry for Warm and Hot Sheet Metal Forming of High Strength Aluminum with Tool Lubrication L. Schell and P. Groche	95
Effect of Friction Modelling on Damage Prediction in Deep Drawing Simulations of Rotationally Symmetric Cups	400
M. Nick, M. Müller, H. Voigts, I.F. Weiser, T. Herrig and T. Bergs	103
Tribological Characteristics of Dual-Pressure Tube Hydroforming G. Ngaile and M. Avila	111
Identifying Heterogeneous Friction Coefficients on the Hot Forming Tools in Mannesmann Cross-Roll Piercing M. Fernandes, N. Marouf, P. Montmitonnet and K. Mocellin	117

Tribological Behavior of High-Strength Aluminum Alloys in Combination with Dry Lubricants at High Forming Temperatures N. Rigas, F. Junker, E. Berendt and M. Merklein	125
Chapter 4: Tribological Aspects of Forging and Extrusion Processes	
Effect of Die Coating on Tearing in Hot Extrusion of 7075 Aluminum Alloy K. Dohda, N. Takatsuji, T. Funazuka and N. Sukunthakan	133
Heat Transfer Coefficient of Zinc Phosphate Coating with Metal Soap during Cold Backward Extrusion O. Kada and Z.G. Wang	139
Optimization of the Steady Combined Forward and Backward Extrusion Test for Higher Sensitivity to Friction in Cold Forging C.L. Hu, S. Osaki, B.X. Cai and M. Aoyama	147
Investigation on the Influence of the Tribological System on Cold Forging and Ejection of Hollow Components with Helical Internal Geometry T. Deliktas, M. Liewald, N. Missal and H. Venzlaff	155
Temperature Dependency of Friction of Titanium Alloy by Forward Rod-Backward can Combined Extrusion Test G. Nishi, Y. Kubota, K. Hayakawa and T. Nakamura	163
Experimental Investigation on Slip Conditions during Thread Rolling with Flat Dies S. Volz and P. Groche	169
Chapter 5: Friction Stir Processing	
Friction Stir Powder Incremental Forming for Fabrication of Sandwich-Structured Composite of Open-Cell Nickel Foam with Aluminum R. Matsumoto, H. Sakaguchi, M. Otsu and H. Utsunomiya	179
Influence of Tool pin Profiles in Friction Stir Welding of Aluminum Alloy and Polycarbonate	
A. Azhagar, K. Hayakawa, H. Shizuka and K. Sakai	185