Influence Of Surface Integrity On Bonding Process

The advent of additive manufacturing (AM) processes applied to the fabrication of structural components creates the need for design methodologies supporting structural optimization approaches that take into account the specific characteristics of the process. While AM processes enable unprecedented geometrical design freedom, which can result in significant reductions of component weight, on the other hand they have implications in the fatigue and fracture strength due to residual stresses and microstructural features. This is linked to stress concentration effects and anisotropy that still warrant further research. This Special Issue of Applied Sciences brings together papers investigating the features of AM processes relevant to the mechanical behavior of AM structural components, particularly, but not exclusively, from the viewpoints of fatigue and fracture behavior. Although the focus of the issue is on AM problems related to fatigue and fracture, articles dealing with other manufacturing processes with related problems are also be included.

This book explores, in a systematic way, both conventional and unconventional material shaping processes with various modes of hybridization in relation to theory, modelling and industrial potential. The demand for high productivity and high accuracy in manufacturing is continuously increasing, based on improvement and optimization strategies. Hybridization of manufacturing processes will play a crucial role and will be of a key importance in achieving environmental and economical sustainability. Structured in three parts, Hybrid Manufacturing Processes summarizes the state-of-the art hybrid manufacturing processes based on available literature sources and production reports. The book begins by providing information on the physical fundamentals of the removal and non-removal processes in macro-, micro and nanoscales. It then follows with an overview of the possible ways of hybridization and the effects on the enhancement of process performance, before concluding with a summary of production outputs related to surface integrity, specifically with respect to difficult-to-machine materials. Considering the applications of different sources of hybridization including mechanical, thermal and chemical interactions or their combinations, this book will be of interest to a range of researchers and practicing engineers within the field of manufacturing.

"Surface Integrity in Machining" describes the fundamentals and recent advances in the study of surface integrity in machining processes. "Surface Integrity in Machining" gathers together research from international experts in the field. Topics covered include: the definition of surface integrity and its importance in functional performance; surface topography characterization and evaluation; microstructure modification and the mechanical properties of subsurface layers; residual stresses; surface integrity characterization methods; and surface integrity aspects in machining processes. A useful reference for researchers in tribology and materials, mechanical and materials engineers, and machining professionals, "Surface Integrity in Machining" can be also used as a textbook by advanced undergraduate and postgraduate students.

Technology — Applications — Effects

Machining Technology and Environmental Degradation Mechanism of Surface Microstructure of Special Materials

The Influence of Machining Processes on the Surface Integrity and Fatigue Life of Hardened 4340 Steel

A Fundamental Study on the Effect of Surface Integrity by Hard Turning Versus Grinding on Rolling Contact Fatigue

Surface Integrity Evaluation and the Effect of Machining-induced Surface Integrity Characteristics on Part's Performance

Metal cutting is a science and technology of great interest for several important industries, such as automotive, aeronautics, aerospace, moulds and dies, biomedicine, etc. Metal cutting is a manufacturing process in which parts are shaped by removal of unwanted material. The interest for this topic increased over the last twenty years, with rapid advances in materials science, automation and control, and computers technology. The present volume aims to provide research developments in metal cutting for modern industry. This volume can be used by students, academics, researchers, and engineering professionals in mechanical, manufacturing, and materials industries. THE SERIES: ADVANCED MECHANICAL ENGINEERING Currently, it is possible to defi ne mechanical engineering as the branch of engineering that "involves the application of principles of physics and engineering for the design, manufacturing, automation and maintenance of mechanical systems". Mechanical Engineering is closely related to a number of other engineering disciplines. This series fosters information exchange and discussion on all aspects of mechanical engineering with a special emphasis on research and development from a number of perspectives including (but not limited to) materials and manufacturing processes, machining and machine tools, tribology and surface engineering, structural mechanics, applied and computational mechanics, mechanical design, mechatronics and robotics, fluid mechanics and heat transfer, renewable energies, biomechanics, nanoengineering and nanomechanics. In addition, the series covers the full range of sustainability aspects related with mechanical engineering. Advanced Mechanical Engineering is an essential reference for students, academics, researchers, materials, mechanical and manufacturing engineers and professionals in mechanical engineering.

Experimental and Applied Mechanics, Volume 4: Proceedings of the 2012 Annual Conference on Experimental and Applied Mechanics, the fourth volume of seven from the Conference, brings together 54 contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Experimental and Applied Mechanics, including papers on: Fracture & Fatigue Microscale & Microstructural Effects in Fatigue & Fracture Material Applications Composite Characterization Using Digital Image Correlation Techniques Multi-Scale Simulation and Testing of Composites Residual Stress Inverse Problems/Hybrid Methods Nano-Composites Microstructure Material Characterization Modeling and Uncertainty Quantification Impact Behavior of Composites

Surface Integrity in MachiningSpringer Science & Business Media

Surface Integrity in Machining

Power Transmissions

A Comparative Study on the Effect of Surface Integrity by Hard Turning Versus Grinding on Tribological Performance

Manufacturing Surface Technology

Stability and Control Processes

Surface integrity generally can be described by its topological, mechanical, and metallurgical. Since the defects produced from different machining can affect the performance of component, experiments always will be conducted to understand the effect of changing operating parameters before new machining strategies are accepted. In this study, surface integrity was characterized by surface roughness and microhardness of titanium alloy Ti-6Al-4V. The objectives of the project are investigating milling parameters effect on surface roughness of titanium alloy and the effect of cutting speed to surface hardness of titanium alloy. Three cutting parameters selected to study their effects on surface integrity which are cutting speed, feed rate, and depth of cut. For surface roughness, five levels of each parameter chosen to see their effects when only one factor will be manipulated while the other are kept constant. The sensitivity of surface roughness value to process parameters shows that the feed has the most influence, followed by radial of depth of cut, while cutting speed has the least influence. For microhardness testing, the only factor manipulated is the cutting speed which three levels selected to observe the microhardness values. The result for microhardness is the higher cutting speed, the lower the surface hardness.

Nitinol is a nearly equiatomic nickel-titanium shape memory alloy (SMA) with two unique properties, i.e., thermal shape memory and superelasticity. Nitinol has broad applications in medical device, aerospace, actuator, machine tool, and civil industries due to its excellent mechanical properties, high fatigue strength, superior corrosion resistance, and good biocompatibility. However, the grand challenges for manufacturing Nitinol components are manifested in two aspects: (i) Nitinol is exceedingly difficult to machine by mechanical cutting due to the very high material strength, high ductility, low temperature of phase transformation, rapid tool wear, and burr formation; and (ii) The requirements of complex geometry, delicate micro features, and superior surface integrity are very stringent for Nitinol components. Electrical discharge machining (EDM) is a competitive technique to machine difficult-to-cut materials. The contact free nature between the workpiece and the electrode avoids severe tool wear and other issues inherited in mechanical cutting processes. In addition, EDM has the advantages in machining of high aspect ratio and complex structures. However, very few studies have been done on EDM of Nitinol. The influence of EDM induced thermal damage on surface integrity and fatigue performance of Nitinol components has not been understood yet. The fundamental relationship between process-surface integrity-fatigue is still unknown. To reveal the underlying EDM process mechanism and its impact on surface integrity and fatigue of Nitinol components, the research focuses are to: (1) Perform a critical assessment on the challenges and outlooks on EDM of Nitinol shape memory alloys. (2) Investigate the surface integrity characteristics of Nitinol components machined by wire-EDM at main cutting and finish trim cutting. (3) Study the crystallography, compositions, and mechanical properties of white layer and reveal the relationship between microstructure and properties of white layers of EDMed Nitinol. (4) Determine the effect of surface integrity on fatigue performance of EDMed Nitinol components. (5) Create a 3-dimensional finite element model accounting for massive random discharges during EDM to simulate the random discharge phenomenon and process effects.

Hard machining is a relatively recent technology that can be defined as a machining operation, using tools with geometrically defined cutting edges, of a work piece that has hardness values typically in the 45-70HRc range. This operation always presents the challenge of selecting a cutting tool insert that facilitates high-precision machining of the component, but it presents several advantages when compared with the traditional methodology based in finish grinding operations after heat treatment of work pieces. Machining of Hard Materials aims to provide the reader with the fundamentals and recent advances in the field of hard machining of materials. All the chapters are written by international experts in this important field of research. They cover topics such as: • advanced cutting tools for the machining of hard materials; • the mechanics of cutting and chip formation; • surface integrity; • modelling and simulation; and • computational methods and optimization. Machining of Hard Materials can serve as a useful reference for academics, manufacturing and materials researchers, manufacturing and mechanical engineers, and professionals in machining and related industries. It can also be used as a text for advanced undergraduate or postgraduate students studying mechanical engineering, manufacturing, or materials.

Physical Fundamentals, Modelling and Rational Applications

The Influence of Cryogenic Machining on Surface Integrity and Functional Performance of Titanium Alloys for Biomedical and Aerospace Applications

Surface Integrity on Grinding of Gamma Titanium Aluminide Intermetallic Compounds

Advanced, Hybrid, Micro Machining and Super Finishing Technology

Effect of Surface Integrity on Fatigue of Structural Alloys at Elevated Temperatures

This book presents the proceedings of one of the major conferences in fatigue, fracture and structural integrity (NT2F). The papers are organized and divided in five different themes: fatigue and fracture mechanics of structures and advanced materials; fatigue and fracture in pressure vessels and pipelines: mechanical behavior and structural integrity of welded, bonded and bolted joints; residual stress and environmental effects on the fatigue behavior; and simulation methods, analytical and computation models in fatigue and fracture.

Advances in Surface Treatments provides information on technologies, applications, and effects of surface treatment processes on different materials. The text is composed of papers that are presented at the AST World Conference, ""Advances in Surface Treatments and Surface Finishing"", held in Paris in December 1986. The book is divided into six parts; each of which discusses a different topic in the field of surface treatment. These topics include thermal and thermochemical surface treatments; mechanical surface treatments and their effects; quality control of surface treated materials; surface finishing; surface coating; laser surface of hardening materials; and the relationship of surface treatment with the environment. Topics such as metallic coatings and special surface treatments are also covered in the book. The text is recommended for engineers who are not yet familiar with surface treatments as well as those who wish to contribute to the research in this field.

With the increased usage of Carbon Fibre Reinforced Plastics (CFRP) Composite Laminate Materials in various industries, an understanding of changes in strength properties and fatigue performance due to manufacturing processes is becoming critical to the study of their performance characteristics. As cured laminates almost always require machining of edges and/or drilling of holes, the resultant surface integrity by such post-cure processes influences the residual strength and fatigue performance during the service life. Unfortunately post-cure manufacturing processes also result in surface and sub-surface damage which evolves during service life conditions and result in the deterioration of strength and fatigue performance. The surface conditions of any machined surface are classified as surface texture and usually represent the exterior microscale geometry of the machined surface. Surface Integrity commonly refers to the features that are sub-surface or immediately beneath the surface. In general the surface integrity consists of the structure and the stress conditions within the interior layers and subsequently dictates the surface mechanical properties. This body of work studies the influence of resultant surface integrity from trimming and drilling of composite laminates on their strength properties, damage evolution and fatigue strength. A two phased approach was utilized in this research study. In phase 1, a 10 ply thick balanced symmetric [0/-45/90/45/0]s composite laminate of unidirectional Carbon fibre prepreg tape with an Epoxy resin was used in the study. For Phase 2, a 22 ply thick balanced symmetric [90/-45/0/-45/90/45/0/-45/0/90/0]s composite laminate of unidirectional Carbon fibre prepreg tape with an Epoxy resin was used. Machining processes used in this study included Abrasive Water Jet (AWJ) and Carbide Router Endmilling for the trimming of the laminate material. For drilling of holes in the laminate material, Polycrystalline Diamond (PCD) drills and Chemical Vapour Deposition (CVD) diamond coated carbide drills were used. Test material was machined with these processes and resultant surface integrity was recorded using a Surface Profilometer, Edge Replication using acetate tape and Scanning Electron Microscopy (SEM). Test samples were generated with varying surface integrity along differing machining processes and standard ASTM Tests conducted to study the residual strength properties. Testing was conducted on edge trimmed specimens included Monotonic Strength (Tension & Compression) as well as Cyclic Strength (Tension-Tension Fatigue). For Drilled Hole Specimens testing included Open-Hole Monotonic Strength (Tension & Compression) and Cyclic Strength (Tension-Tension Fatigue). Similar tests were conducted for Pinned-Hole strength testing for static conditions. During Tension-Tension Fatigue Testing a percentage change in stiffness was used to determine resultant fatigue life and it correlation to surface integrity. During the fatigue testing process, damage evolution was studied using Optical Microscopy, Photography and Scanning Electron Microscopy. The analytical modeling of Fatigue Damage composite laminates was based on damage progression. A damage model based on a change in compliance (stiffness) was used as the analytical model in this study based on the utilization of change in stiffness and resultant fatigue life to record the damage progression during the Tension-Tension Fatigue Testing.

Influence of Surface Integrity on the Plastic Flow in Analogous Testing of 42CrMo4

Dry Full Forward Extrusion by Textured Workpieces and Self-Lubricating Tool Coatings

A Fundamental Study on the Impact of Surface Integrity by Hard Turning on Rolling Contact Fatigue

Grinding Effects on Surface Integrity, Flexural Strength and Contact Damage Resistance of Coated Hardmetals

Surface integrity (SI) is the integrated surface behavior and condition of a material after being modified by a manufacturing process; it describes the influence of surface properties and characteristics upon material functional performance. As the leading-edge field of manufacturing research, SI finishing/machining and the consequent machining-induced complex combination of surface roughness, residual stress, work-hardening, macro and microstructure transformation, strongly affect the fatigue and stress behavior of machined parts. This kind of influence is particularly sensitive and pronounced in the difficult-to-machine materials, which are typically chosen for the most critical applications in the automobile, aerospace and nuclear industry. Thus, well-designed SI processing requirement and accurate SI evaluation model are essential to control and ensure the surface quality and functional performance for these key parts. In this thesis, an SI descriptive model for quantitative characterization and evaluation of surface integrity is proposed based on five principal SI characteristics. Considering the nature of surface integrity, a conceptual framework of an SI model for machined parts is established, in which the SI model is constructed based on the correlations between SI manufacturing processes, SI characteristics and final functionality. This model offers a theoretical basis and guideline for controlling SI characteristics and improving fatigue properties for machined parts. An empirical model for estimating the SI-characteristics-caused effective stress concentration factor (SCF) is established with fatigue life as the evaluating indicator. For a typical difficult-to-machine material, GH4169 superalloy, usually used in internal combustion engines, its grindability and the influence of processing parameters on the five principal SI characteristics are investigated in detail. The correlations between the processing parameters and the SI characteristics, between the processing parameters and the fatigue properties, and between the SI characteristics and the fatigue properties, are analyzed based on an orthogonally-designed grinding experiment and corresponding rotary bending fatigue testing for GH4169 samples within the selective range of grinding processing parameters. The feasibility and effectiveness of the proposed model for estimating the SI effective SCF are also validated by the experimental results, and this has actually offered an equivalent and convenient means for evaluation of SI and fatigue properties. Finally, the conclusions and contribution of the research are discussed, and potential future work to build on this research is identified.

Surface integrity is a subject covering the description and control of the many possible alterations produced in the surface of a component during manufacturing. Surface integrity is evaluated by measuring the influence of machined surface layers on component reliability. This is accomplished primarily through fatigue testing under both low-cycle and high-cycle conditions. Considerable data have been developed permitting definition of characteristic changes in fatigue strength of a variety of high-strength structural alloys as a function of several different metal removal methods and also variations within these methods.

Gamma-TiAl is an ordered intermetallic compound characterized by high strength to density ratio, good oxidation resistance, and good creep properties at elevated temperatures. However, it is intrinsically brittle at room temperature. This thesis investigates the potential for the use of grinding to process TiAl into useful shapes. Grinding is far from completely understood, and many aspects of the individual mechanical interactions of the abrasive grit with the material and their effect on surface integrity are unknown. The development of new synthetic diamond superabrasives in which shape and size can be controlled raises the question of the influence of those variables on the surface integrity. The goal of this work is to better understand the fundamentals of the abrasive grit/material interaction in grinding operations. Experimental, analytical, and numerical work was done to characterize and predict the resultant deformation and surface integrity on ground lamellar gamma-TiAl. Grinding tests were carried out, by analyzing the effects of grit size and shape, workpiece speed, wheel depth of cut, and wear on the subsurface plastic deformation depth (PDD). A practical method to assess the PDD is introduced based on the measurement of the lateral material flow by 3D non-contact surface profilometry. This method combines the quantitative capabilities of the microhardness measurement with the sensitivity of Nomarski microscopy. The scope and limitations of this technique are analyzed. Mechanical properties were obtained by quasi-static and split Hopkinson bar compression tests. Residual stress plots were obtained by x-ray, and surface roughness and cracking were evaluated. The abrasive grit/material interaction was accounted by modeling the force per abrasive grit for different grinding conditions, and studying its correlation to the PDD. Numerical models of this interaction were used to analyze boundary conditions, and abrasive size effects on the PDD. An explicit 2D triple planar slip crystal plasticity model of single point scratching was used to analyze the effects of lamellae orientation, material anisotropy, and grain boundaries on the deformation.

Theory, Modelling, and Applications

Influence of Grinding and Cavitation on Surface Integrity of Stainless Steel

A Study of Machining Effects on the Surface Integrity, Strength Properties, Damage Evolution and Fatigue Strength of Composite Laminates

Advances in Surface Treatments

Proceedings of the 17th International Conference on New Trends in Fatigue and Fracture

Advanced Machining Processes of Metallic Materials: Theory, Modelling and Applications, Second Edition, explores the metal cutting processes with regard to theory and industrial practice. Structured into three parts, the first section provides information on the fundamentals of machining, while the second and third parts include an overview of the effects of the theoretical and experimental considerations in high-level machining technology and a summary of production outputs related to part quality. In particular, topics discussed include: modern tool materials, mechanical, thermal and tribological aspects of machining, computer simulation of various process phenomena, chip control, monitoring of the cutting state, progressive and hybrid machining operations, as well as practical ways for improving machinability and generation and modeling of surface integrity. This new edition addresses the present state and future development of machining technologies, and includes expanded coverage on machining operations, such as turning, milling, drilling, and broaching, as well as a new chapter on sustainable machining processes. In addition, the book provides a comprehensive description of metal cutting theory and experimental and modeling techniques, along with basic machining processes and their effective use in a wide range of manufacturing applications. The research covered here has contributed to a more generalized vision of machining technology, including not only traditional manufacturing tasks, but also potential (emerging) new applications, such as micro and nanotechnology. Includes new case studies illuminate experimental methods and outputs from different sectors of the manufacturing industry Presents metal cutting processes that would be applicable for various technical, engineering, and scientific levels Includes an updated knowledge of standards, cutting tool materials and tools, new machining technologies, relevant machinability records, optimization techniques, and surface integrity

Surface Integrity of machined surfaces is defined based on various constituents e.g. surface roughness, microstructure, surface hardening and microhardness, which all are influenced by machining parameters such as coolant, cutting speed, tool wear, feed, depth of cut and tool material and its geometry. An effort has been made in this book to study the effect of slab down milling process parameters on surface integrity of HSLA (ASTM A572 Grade 50). Experiments were performed as per Taguchi L18 orthogonal array for different combinations of machining parameters to collect data which were subsequently statistically analysed to optimize multi-performance characteristics. This book explains in detail the procedure for conducting experiments and using grey relational analysis for multi-performance characteristics optimization. It is meant for students and researchers of production and industrial engineering.

This book presents papers from the International Conference on Power Transmissions 2016, held in Chongqing, China, 27th-30th October 2016. The main objective of this conference is to provide a forum for the most recent advances, addressing the challenges in modern mechanical transmissions. The conference proceedings address all aspects of gear and power transmission technology and a range of applications. The presented papers are catalogued into three main tracks, including design, simulation and testing, materials and manufacturing, and industrial applications. The design, simulation and testing track covers topics such as new methods and designs for all types of transmissions, modelling and simulation of power transmissions, strength, fatigue, dynamics and reliability of power transmissions, lubrication and sealing technologies and theories, and fault diagnosis of power transmissions. In the materials and manufacturing track, topics include new materials and heat treatment of power transmissions, new manufacturing technologies of power transmissions, improved tools to predict future demands on production systems, new technologies for ecologically sustainable productions and those which preserve natural resources, and measuring technologies of power transmissions. The proceedings also cover the novel industrial applications of power transmissions in marine, aerospace and railway contexts, wind turbines, the automotive industry, construction machinery, and robots.

Influence of Surface Shape on Surface Integrity in 2.5D Cutting End Milling
Fatigue and Fracture Behaviour of Additively Manufactured Mechanical Components
Modern Machining Technology
Surface Integrity & Functional Performance
The Fundamental Relationship Between Tool Wear, Surface Integrity, and Fatigue in Milling of Difficult-to-cut Alloys

The first title in the ""Manufacturing Engineering Modular"" series, the publication of this book marks recognition of the effect of surface finish obtained in manufacture (""surface integrity"") on the functional performance of product, in terms of such factors as fatigue, corrosion and strength. It is a concise work, intended chiefly for undergraduate and postgraduate students, which should also provide useful material for the professional manufacturing engineer.

This book contains the Proceedings of the 13th World Conference on Titanium.

Modern Machining Technology: Advanced, Hybrid, Micro Machining and Super Finishing Technology explores complex and precise components with challenging shapes that are increasing in demand in industry. As the first book to cover all major technologies in this readers will find the latest technical developments and research in one place, allowing for easy comparison of specifications. Technologies covered include mechanical, thermal, chemical, micro and hybrid machining processes, as well as the latest advanced finishin technologies. Each topic is accompanied by a basic overview, examples of typical applications and studies of performance criteria. In addition, readers will find comparative advantages, model questions and solutions. Addresses a broad range of modern machining t providing specifications for easy comparison Includes descriptions of the main applications for each method, along with the materials or products needed Provides the very latest research in processes, including hybrid machining

Some Studies on Surface Integrity of MacHined Surfaces

Influence of Size Effects on Surface Generation During Finish Machining and Surface Integrity in Ti-6Al-4V

Proceedings of the 2012 Annual Conference on Experimental and Applied Mechanics

The Influence of Net Shape Machining on the Surface Integrity of Metals and Fiber Reinforced Plastics

Thermal Machining Processes

Forest trees cover 30% of the earth's land surface, providing renewable fuel, wood, timber, shelter, fruits, leaves, bark, roots, and are source of medicinal products in addition to benefits such as carbon sequestration, water shed protection, and habitat for 1/3 of terrestrial species. However, the genetic analysis and breeding of trees has lagged behind that of crop plants. Therefore, systematic conservation, sustainable improvement and pragmatic utilization of trees are global priorities. This book provides comprehensive and up to date information about tree characterization, biological understanding, and improvement through biotechnological and molecular tools.

Tool wear is the critical factor to determine machining economy since it is directly related to tool life and the overall cost of production. Surface integrity (surface finish, microstructure, residual stress, microhardness, and surface chemistry) and service performance (e.g. fatigue life) of machined components can be also adversely affected by tool wear because they deteriorate to an unacceptable level with the progression of tool wear. Therefore, it is necessary to understand and establish the basic relationship between tool wear, surface integrity, and fatigue performance in order to give a general guidance for producing as many quality parts as possible while minimizing machining costs. This study starts with a critical assessment of literature on surface integrity in machining of difficult-to-cut alloys. To significantly improve the accuracy and repeatability of tool wear measurement, a novel online optical tool inspection system has then been developed to integrate with a CNC machining center to monitor tool wear in milling. The progression of tool flank wear of PVD coated inserts in end milling of AISI H13 tool steel and Inconel 718 superalloy were presented to demonstrate the function of the optical tool inspection system. A Taguchi design-of-experiment based dry finish milling of AISI H13 tool steel (50 ± 1 HRc) with (Ti, Al)N/TiN coated cutting tools was conducted to investigate the process-induced surface integrity. The mechanism of surface integrity in hard milling was investigated to understand the effects of mechanical/thermal loads on surface microstructure and properties. The microstructure, microhardness and residual stresses were characterized. A phase transformed white layer was not observed in the context of concerned process parameters. The milled surfaces are characterized by the increased microhardness and high compressive residual stresses, which are beneficial for improving fatigue performance and wear resistance of the machined components. Finally, the process design space for the desired surface integrity has been established via the microhardness and residual stress maps. By using the online optical tool inspection system, tool wear effect on surface integrity and fatigue life of AISI H13 tool steel by dry hard milling using PVD coated tools are studied. The evolutions of surface integrity were characterized at different levels of tool flank wear. At each level of tool flank wear, the effects of cutting speed, feed, and radial depth-of-cut on surface integrity were investigated respectively. It shows that surface roughness in the step-over direction is much higher than that in the feed direction under all the milling conditions. The increased tool wear did not necessarily produce a rougher surface in both directions. Optical images of the subsurface microstructure of the machined samples do not show a noticeable white layer or heat affected zones which may be explained by the characteristic of periodic tool/work contact in milling compared to turning and grinding. Residual stresses are compressive in both directions and are more compressive in the step-over direction than the feed direction. Four-point bending fatigue tests were performed using the samples machined at different flank wear conditions. The results show that generally a worn tool reduces fatigue life, and the larger the tool wear, the shorter the fatigue life. The fractured surfaces of fatigued samples were characterized. Fatigue endurance limits of the machined surfaces at different reliability levels were estimated and correlated with the experimentally determined fatigue life. Tool wear effect on surface integrity and fatigue life of Inconel 718 superalloy by milling using PVD coated tools are also studied. The evolutions of surface integrity including surface roughness, microstructure, and microhardness were characterized at three levels of tool flank wear (VB = 0, 0.1 mm, 0.2 mm). At each level of tool flank wear, the effects of cutting speed, feed, and radial depth-of-cut on surface integrity were investigated respectively. End milling can produce surface finish between 0.1 ?m and 0.3 ?m under most of the conditions. Roughness is generally higher in step-over direction than feed direction. No obvious white layer is observed in subsurface microstructure. The machined surface is significantly work-hardened due to the dominant mechanical loading. Four-point bending fatigue test shows that none of the milled samples failed within four million cycles. Fatigue endurance limits of the machined samples at different reliability levels were calculated and correlated with the experimentally determined fatigue life.

Aus ökonomischen, ökologischen und legislativen Gründen ist es notwendig Schmierstoffe zu substituieren. Insbesondere in der Kaltmassivumformung ist dies aufgrund von hohen Belastungen schwer umsetzbar. Der Ansatz dieser Dissertation ist es mithilfe einer vom Institut für Oberflächentechnik entwickelten Werkzeugbeschichtung und einer Texturierung der Halbzeuge eine Trockenumformung zu ermöglichen. Die Ergebnisse haben eine Machbarkeit gezeigt, jedoch ist adhäsiver Verschleiß ein Problem.

Influence of Grinding Operations on Surface Integrity and Chloride Induced Stress Corrosion Cracking of Stainless Steels

Proceedings of the International Conference on Power Transmissions 2016 (ICPT 2016), Chongqing, P.R. China, 27-30 October 2016

Investigation on Surface Integrity of Titanium Alloy in Milling Operation

Experimental and Applied Mechanics, Volume 4

Processing-surface Integrity-fatigue Relationship in Electrical Discharge Machining of Nitinol Shape Memory Alloy

This thesis assesses the influence of substrate surface integrity on different mechanical (flexural strength and contact damage resistance under spherical indentation) and tribological (scratch resistance as well as cracking and delamination response under Brale indentation) properties for a TiN-coated fine-grained hardmetal grade (WC-13 wt.%Co). In doing so, three different surface finish conditions are studied: as-sintered (AS), ground (G), mirror-like polished (P) and ground plus thermal annealed (GTT). Moreover, a relevant part of the work is devoted to nude hardmetal substrates. The result indicates that grinding induces significant alterations in the surface integrity. It yielded in high roughness and emergence of a topographic texture; anisotropic distribution of microcracks within a thin subsurface layer; severe deformation, microstructure refinement and phase transformation of binder regions; and large compressive residual stresses. Subsequent ion etching and coating deposition resulted in a significant residual stresses decrease while damage induced by grinding was not completely removed in the substrate surface. On the other hand, high temperature annealing (GTT condition) completely relieved the referred residual stresses, but without inducing any additional change in terms of existing damage. This was not the case for the metallic binder phase where such treatment induced an unexpected microporosity, development of a recrystallized subgrain structure and reversion of grinding-induced phase transformation. Strength of hardmetals was significantly enhanced by grinding, as compared to AS and P conditions. Such beneficial effect is partly lost during the subsequent ion etching and coating deposition stages. On the other hand, strength of coated GTT condition increases compared to that of the corresponding uncoated one. Systematic residual stress analysis combined with extensive fractographic inspection reveal that strength variations measured after individual manufacturing chain or heat treatment steps (grinding, ion-etching, coating and/or thermal annealing) may be rationalized on the basis of effective residual stress state and location, either at the surface or at the subsurface, of strength-controlling flaws. Independent of substrate surface finish, coated AS, G and P samples exhibit similar critical load for initial substrate exposure as well as same predominant failure mode as they get scratched. However, clear differences in the failure scenario were evidenced. Scratch track for G samples exhibited discrete and localized substrate exposure, compared to the more pronounced and continuous exposure for AS and P ones. On the other hand, GTT samples showed lower critical load and changes in the mechanisms for the scratch-related failure; the latter depending on the relative orientation between scratch and grinding directions. Coated hardmetals exhibit more brittleness and lower adhesion strength, under Brale indentation testing conditions, with decreasing binder content. Grinding is discerned to promote delamination, compared to the polished condition, but also to strongly inhibit radial cracking. Such a response is analyzed on the basis of the interaction between elastic-plastic deformation imposed during indentation and several grinding-induced effects: remnant compressive stress field, pronounced surface texture and microcracking within a thin microcracked subsurface layer. Contact damage resistance of coated hardmetals, subjected to spherical indentation, is enhanced by grinding of the substrate previous to coating stage. Such beneficial effects are discerned regarding both crack nucleation at the coating surface and subsequent propagation into the hardmetal substrate. The grinding-induced compressive residual stresses are pointed out as the main reason for the improved response against contact loading. Such statement is sustained by the lower damage resistance evidenced in coated GTT specimens.

Tree Biotechnology

Proceedings of the 13th World Conference on Titanium

Advanced Machining Processes of Metallic Materials

Influence of Modern Machining Processes on the Surface Integrity of High-entropy Alloys

Proceedings of the 4th International Conference Dedicated to the Memory of Professor Vladimir Zubov