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Study on AISI1045 Material for Various Applications: An over View

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Abstract

In the present day, Manufacturing plays a key role in the Industries. Recent studies and work carried out on AISI 1045 medium low carbon steel with various methods such as turning, milling, machining, nitriding, boride layers, drilling, laser process, cold forming, cryogenic thin film deposition, grind hardening, fatigue tests, EDM, Microstructures, ANN, Brazed process, corrosion and Nano indentation related studies are reviewed, which includes Analytical models, Numerical methods, Finite element methods, and Micro structural studies, etc.,

Keywords: AISI 1045, machining, corrosion, Nitriding

1. INTRODUCTION

The material used in this work was AISI 1045 steel with the following chemical compositions (wt. %): C: 0.45, Si: 0.17, Mn: 0.52, S: 0.031, P: 0.032 and Fe balance [23]. Though AISI 1045 steel has been widely used in practical applications due to its excellent combined properties, it is necessary to further improve its wear resistance and corrosion resistance by surface modification in order to extend its service life and enlarge the applications [23].

2. TURNING:

Tool wear characterizations on AISI 1045 steel by using P25 cemented carbide is studied under MQCL conditions and MQCL +EP/AW additive [1].Serrated chip formation during the turning process, the evolution of heat flux during formation of saw tooth chip are known by theoretical and analytical methods respectively [6].Tests on AISI 1045 steel by indirect cooling of cutting tool by continuous and interrupted cuts [21].

S.Buchkermer [26] et al studied predictive modeling in Turning of AISI 1045, fracture models for chip breakage in FEA, by comparing regression analysis for Chip formation models, SEM images and simulated chips are compared.

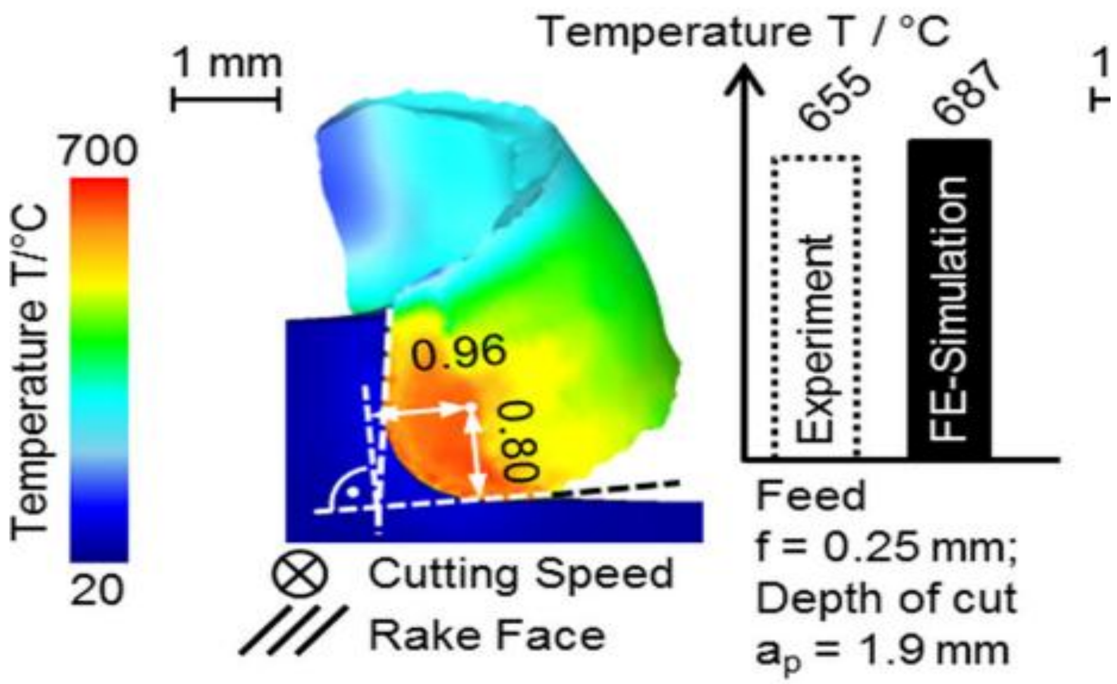

Fig1: FEA model S. Buchkermer [26] et al

Influence of machining parameters and an approach angle of carbide inserts by using hybrid gray fuzzy algorithm [27].

A. Garg et al studied generalized power consumption models (MGGP) algorithm It was also found that the cutting speed has the most significant impact on the power consumption in turning of AISI 1045 steel and the Turning of 7075 Al alloy.

The generalized EN-MGGP models obtained can easily be optimized analytically for attaining the optimum input parameter settings that optimize the product quality and power consumption simultaneously.

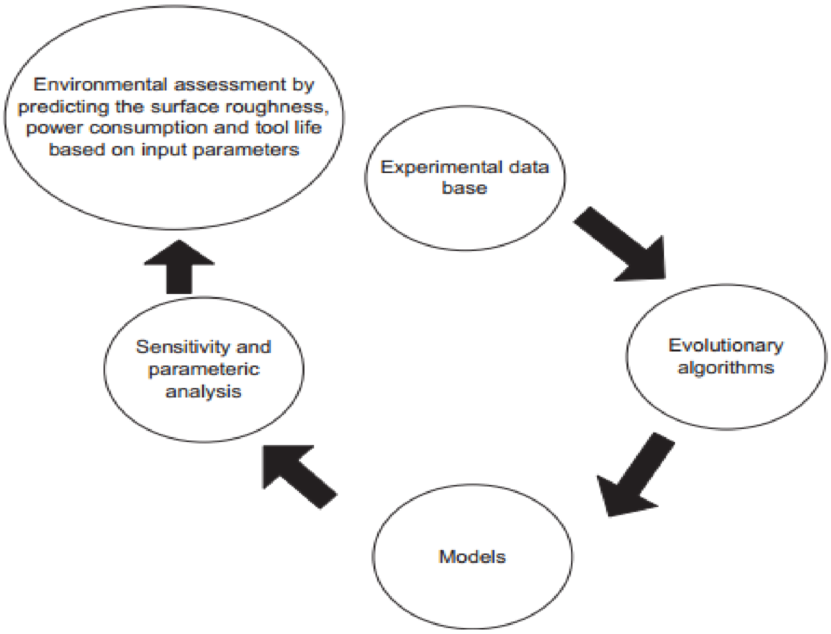

Fig 2: Study of environmental impacts using the models formulated by evolutionary algorithm

Mohammad lotif [41] et al studied experimental and FEM based approaches in Turning with AISI 1045 and tungsten carbide inserts with various chip breaker geometries. Chip breaker has an increasing effect on cutting force value.

S.Buchkermer [43] et al studied longitudinal turning on AISI 1045 by using FEM extended MBW model.MBW model belongs to the group of coupled phenomenon logical damage models.

N. Senthil kumar [50] et al has studied tool geometry selection and optimization by using turning operation on AISI 1045, cutting insert, nose radius and the relief angle of the tool are analyzed by using ANOVA.

Girish Kant [59] et al has studied predictive model for minimization of power consumption and surface roughness by using gray relational analysis, response surface methodology. Robson [62] et al have made studies of AISI 1045 to analyze surface roughness and cutting force by using Scott –Knott method Scott –Knott method is which is a method of grouping means that categories results without ambiguity. Aldo Attanasio [63] et al studied comparison between response surface methodology (RSM) and artificial neural networks (ANNs) fitting techniques for tool wear forecasting was performed. H. Plus [69] et al made studies on AISI 1045/AISI 4140/ Inconel 718, he conducted experimental tests to analyze Temperature dependent friction model by using FEM.

Piotr Nieslony[71] et al has studied FEM based studies on the influence of thermal physical properties of work and cutting tool materials by using Ozel's & kalhori's model temperature distribution on rake face within wedge body and cutting forces are determined.

Rogov vladmir [77] et al have studied the effects of cutting conditions and tool construction on surface roughness and natural frequency in turning of AISI 1045, tool over hang is affecting the natural frequency. Ajay Mishra [80] et al have studied Taguchi techniques, optimum tool flank wear by using an L9 orthogonal array, S/N ratio‘s, ANOVA, cutting speed is the most influencing parameter. Farhad kolahan [103] et al has studied surface roughness related to surface quality, machining parameters, and tool geometry specifications. A. Esteves corriea [104] et al has studied wiper inserts used in turning and surface quality in work piece of mechanics precision, without grinding operations. S.Rizzuti [109] et al has worked on residual stresses that occur during turning of AISI 1045 surface and subsurface through FEA analysis and same compared to experimental data. Young kug hwang [111] et al has worked on wet turning process, MQL to predict cutting force and surface roughness, cutting conditions in MQL and wet turning process.

3. **MACHINING**

Hard machining has been recognized as an effective and efficient manufacturing process to replace the grinding of hardened material. Metal cutting is one of the most important and common manufacturing approaches in the industry nowadays. High-speed cutting (HSC) has been widely applied in the mould, automobile, astronautics, and optical engineering, being of increasing industrial interest, because of its advantages of allowing for larger material removal rates and positive influence on the properties of the finished work piece.

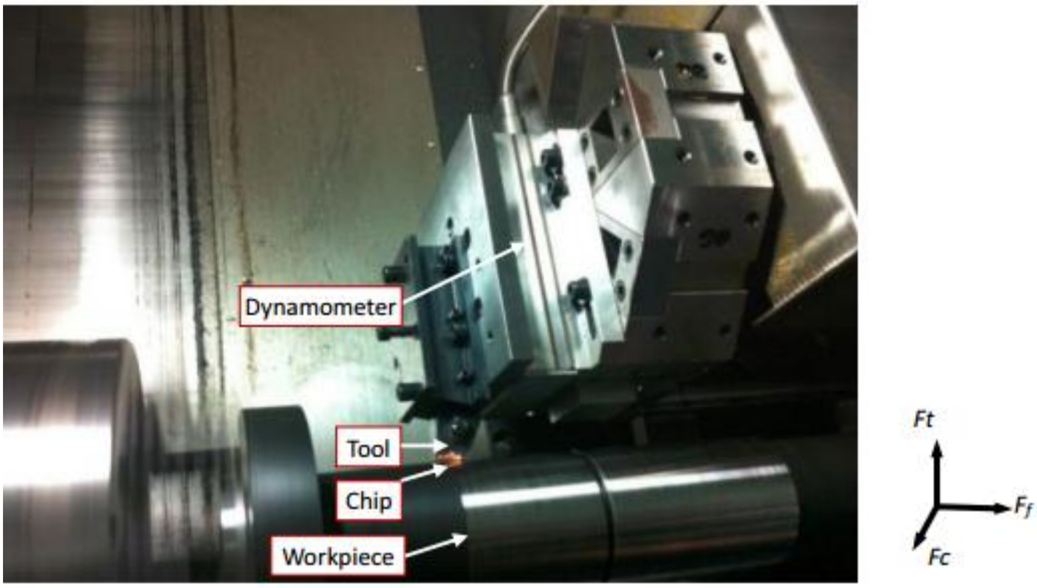

Fig: 3 Experimental setups of hard machining with cutting forces measurement system [15].

X.P. Zang [15] et al has studied factors in controlling micro and macro chip morphologies. AISI 1045 steel with PCBN tool with chip breaker.For hard machining chip morphology and serrated chip, morphology is also studied. Hard machining can be used for replacing of grinding.

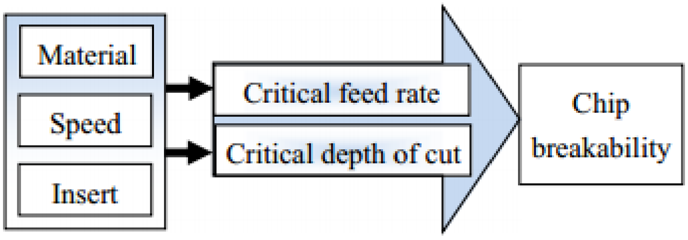

Fig 4: Factors that influence chip breaking [15].

S.V Subramanian [17] et al have studied the change of chip morphology with increasing cutting speed by considering the role of microstructure evolution in chip root, chips are collected to study the change in microstructure by SEM.

Hedrick plus [20] et al has studied thermal effects in the cutting process, FEM for the dry cutting process. Eulerian –Lagrangian method is used to simulate chip formation and to study Temperature distribution within work piece chip and tool.

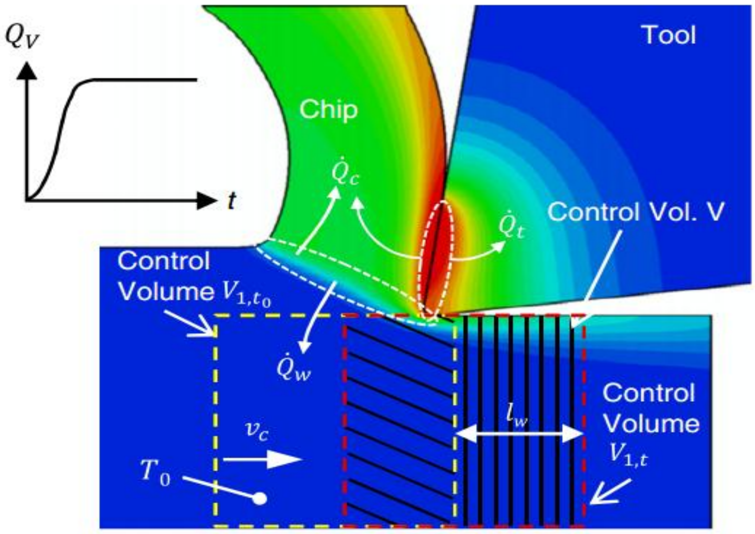

Fig 5: Control volume method to calculate heat flux into work piece [20].

Tao Zang [22] et al have studied mechanical micro cutting to manufacture the miniature parts.The uncut chip thickness and cutting edge radius are taken as input parameter predicted cutting force using the shear flow stress is validated by the micro orthogonal cutting process. Johnson –cook constitutive model is used to find the shear strain hardening, PSG effects.

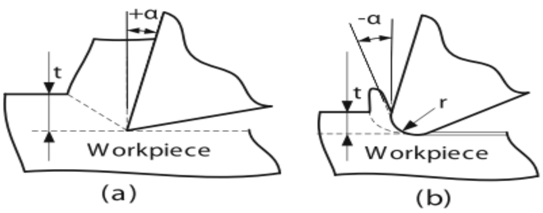

Fig6 (a): Systematic cutting edge (a) macro cutting (b) micro cutting [22]

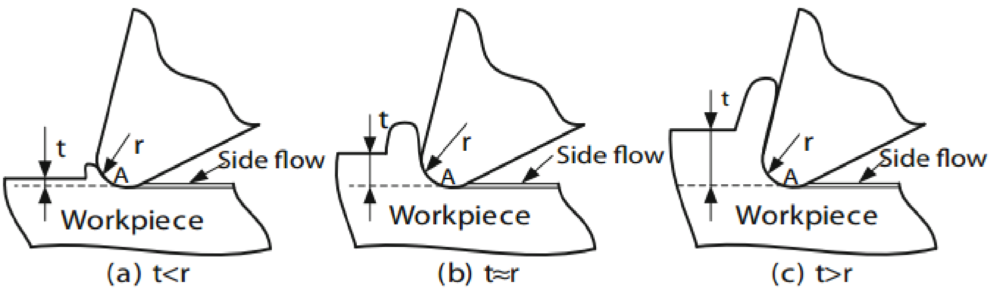

Fig6 (b): Chip formation due to cutting edge radius in the micro cutting process [22].

Lei wan [25] et al have studied the mechanism of serrated chip formation of AISI 1045 at the rate of (60 to 1200 m/min). Simulation is done by using Johnson –cook model. It has been shown that flow stress is influenced simultaneously by the strain rate hardening and temperature softening. When the speed reaches very high, the temperature softening will fail, and the strain rate hardening will play a more important role. Jianfeng Ma [32] et al have studied the performance of micro grooved cutting tool on AISI 1045 The purpose is to examine the effect of microgroove textured tools on machining performance and to compare it with non textured cutting tools.Groove width, groove depth, edge distance have an influence on cutting.Micro groove cutting tool has low cutting force, thrust force, lower energy for machining.

Jianfeng Ma [35]et al have studied the effects of micro grooves on friction and wear of textured tools compared with nontextured tools, micro grove cutting tool can reduce friction and wear in machining, reduces chip tool contact length. Asarlan Qasim[40] et al have studied optimization of machining parameters with multiple cutting tools, by using Taguchi The effects of varying cutting speed, feed rate, depth of cut, and rake angle in the orthogonal cutting process have been considered. VincentA.Balogun [53] et al has studied the specific electrical energy demand in machining and model its relationship to a thickness of material removed specific energy evaluated in cutting tests was empirically modelled.

F.kolcke [73]et al have studied visco plastic work material behavior during machining process and new inverse methods of identifying the flow stress data during orthogonal machining derived method is applied for machining of AISI 1045, Inconel 718.The experiments include high speed filming the chip formation, measuring cutting forces and temperature

Gu liyo [75] et al has studied adiabatic shear localized fracture (ASLF).To develop a deep study on damage evolution mechanism. ASLF in chip formation is investigated under an optical microscope and scanning electron microscope (SEM) through high-speed machining experiment of hardened AISI 1045 steel at a relatively high cutting speed. C.Courbon [76] et al has studied Tool-chip contact zones are analyzed by SEM-EDS and sticking and sliding parts are dissociated. A formation mechanism of a Thermal Contact Resistance (TCR) is proposed from the real contact area extracted. A Finite Element (FE) model based on the Arbitrary–Lagrangian–Eulerian (ALE) approach is then employed to investigate the influence of such thermal contact conditions on the cutting process.

Ghorbani siamak[77]et al have studied the effects of cutting conditions and tool construction on surface roughness and natural frequency in turning AISI 1045 Three levels of feed, depth of cut, cutting speed and tool over hang .Taguchi method L9 orthogonal array was applied to design of the experiment. Spindle speed has the significant effect of the surface roughness, while tool overhang is the dominant factor affecting natural frequency for both cutting tools.

C. Courbon et al have studied FE physical modeling of a dry cutting on AISI 1045 by using material constitutive models [78].

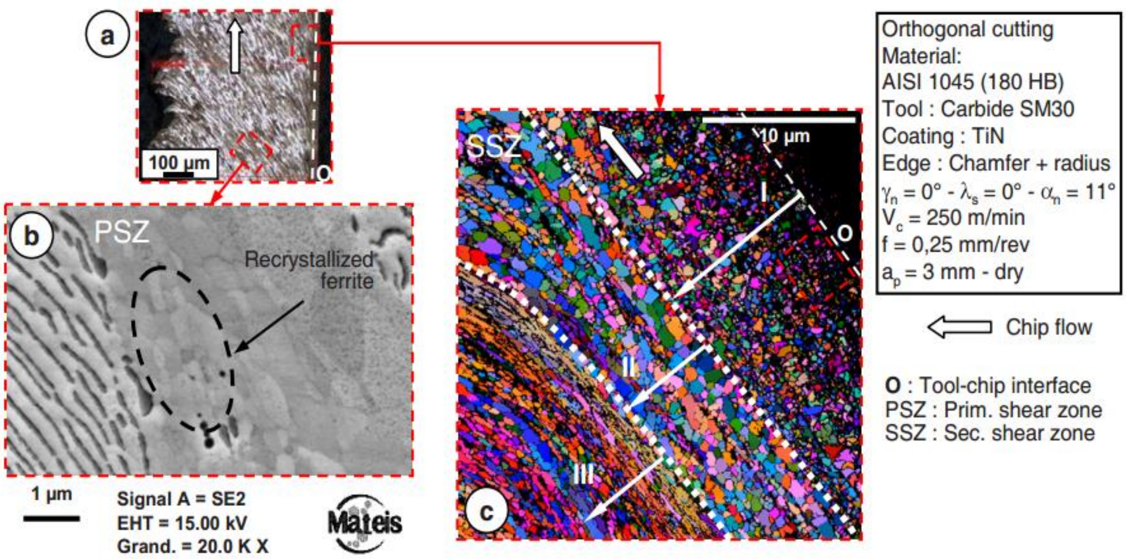

Fig 8: SEM and EBSD analysis showing a recrystallized structure [78].

Yang qibiao [82] et al has studied chip formation at different cutting speeds about chip deformation and frequency of serration. After Inlay and polishing of collected chips, morphology is collected by using VHX -600Eso by this morphology cutting speed influence is known.

G.G.Ye [83] et al have studied high-speed cutting experiments were performed on AISI 1045 sheets of steel. Cutting speeds (30m/s to 200m/s) by using light gun technology. Nicoleta lungu [84] et al have studied information on deformations stress and temperatures by using six trails of simulation with DEFORM 2D .cutting speed and temperature increases, cutting forces decreases.

H. Ben abdelai[85] et al have studied similar conditions to simulate tribological phenomena as the ones occur at tool chip work piece interface in metal cutting It is been shown that sliding velocity is the most influential parameter.

N.Senthil Kumar [89] et al have studied optimization of machining and geometrical parameters during machining and a suitable L18 orthogonal array is selected for DOE and simulation analysis, by S/N ratio analysis cutting insert shape is the most predominant factor.

Cedric Courbon [99] et al have studied friction model and heat partition model at this interface, new tribometer is used to measure pressures, temperatures, and sliding velocities.

4. NITRIDING:

Plasma nitriding (PN) has been proven to be one of the most effective methods to improve surface hardness and wear resistance of most metal materials [2]. Plasma nitriding (PN), plasma carburizing (PC), and plasma nitro carburizing (PNC) are proved to be effective surface modifications and have been adopted by most industries. In the past decades, PN and PNC have become popular surface modification techniques, as they are more environment friendly than those using gas sources and solid powders [14].

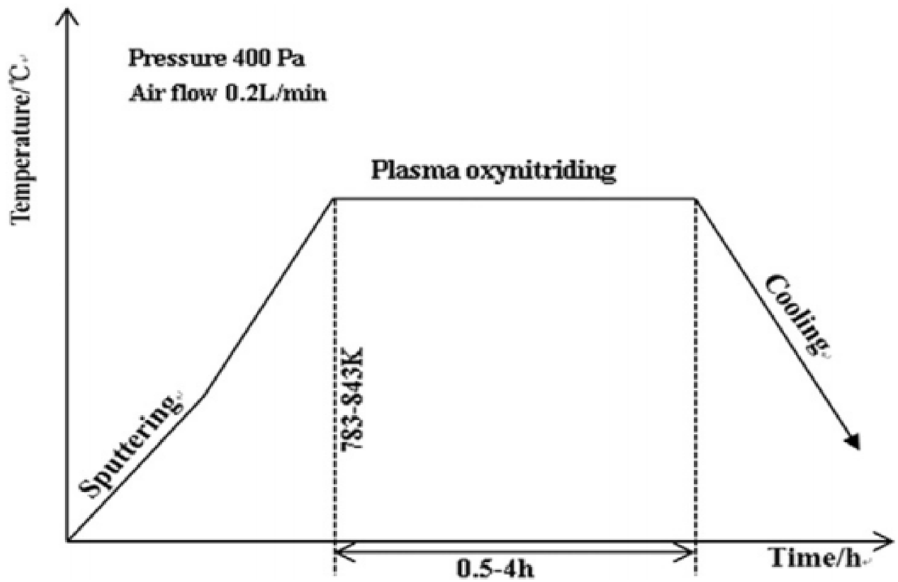

Fig 9: The experimental description of nitriding cycles.

Bin Miao [2]et al have studied plasma nitriding surface treatment on AISI 1045 to improve surface hardness and wear resistance .work piece is heated at 1123k for 8 min and tempered for 853k for 30min.AISI 1045 is under gone sand blasting and cleaned by ethanol. The results showed that sand blasting could enhance the nitriding efficiency and bring about much thicker nitrided layer than that of the nitrided-only sample under the same plasma nitriding condition, and the higher nitriding efficiency could be ascribed to the higher surface free energy.Bin Miao [14] et al have studied a novel duplex treatment (DT) combining plasma nitro carburizing (PNC) and plasma nitriding (PN) was primarily developed for AISI 1045 steel. The modified samples were investigated by optical microscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), micro hardness test, and pin-on-disk tribotest. Han Liu [23] et al have studied plasma oxynitride and plasma nitriding both process to study micro structure, the surface morphology of compound layers. Air addition can promote diffusion of Nitrogen atoms towards the substrate. Kinetics has a good agreement. Han Liu [28] et al have studied plasma oxynitride for AISI 1045 by using plain air; effect of air flow in PON has higher efficiency and corrosion resistance than plasma nitriding. S.Sanjari [33]et al has studied titanizing of AISI 1045 by using (Alc+Alumina at 950ºc) followed by plasma nitriding. Lower titanizing time and high plasma nitriding temperature can give high wear resistance and hardness.

Farahnaz haflang [37] et al has studied improving electro chemical properties of AISI 1045 by applying aluminum nitride +3.5 % NaCl solutions through potential dynamic polarization and EIS by duplex treatment. Topological and structures studies of modified surfaces by SEM. Lin chang Tsai [42]et al have studied chromized coatings on AISI 1045 carbon steel using bipolar plates of proton exchange membrane fuel cells by low-temperature pack chromization.

S.Buchkermer [43]et al has studied AISI 1045 on longitudinal turning, FEM extended MBW model, the influence of the state of stress and strain hardening behavior and three cutting forces were measured Farahnaz haftlang [47]et al has studied duplex surface treatment(plasma nitriding and aluminizing) on AISI 1045 steel. A number of work pieces were aluminized and subsequently, plasma nitrided (Al–PN) and other work pieces were plasma nitrided and then aluminized (PN–Al) and Fabricated steels were testing under SEM &XRD.Farahnaz haftlang [49]et al have studied duplex treatment on AISI 1045, AIN has a dominant phase.AIN detected on steel after plasma nitriding at 823k.

S.M.H.Hojjatzadeh [92] et al have studied the effects of varying the addition of nitrogen to GTA surface alloying of an AISI 1045steel substrate, the different addition of nitrogen on AISI 1045.Two microstructures with Tin and Ti($c_x n_y$). F.Hakami [96] et al has studied AISI 1045 steel specimens were plasma nitrided at 803 K for 5 h, in a gas mixture of 75% N_2+25%H_2. The specimens were then chromized in powder mixtures consisting of ferrochromium, ammonium chloride and alumina at 1273 K for 5 h. Scanning electron microscopy (SEM), X-ray diffraction (XRD) analysis and Vickers micro-hardness test were used as characterizing techniques. F.Hakami[97] et al has worked on duplex surface treatment on AISI 1045 steel through plasma nitriding of chromized layer, The hardness of the duplex layers was significantly higher than the hardness of the base material or chromized layer.Chingyuan bai[106]et al have made studies on AISI1045 to produce anti corrosive and highly conductive coating using a rolling pre treatment along with low-temperature pack chromization The results indicated that a uniform and dense chromized coating was successfully formed on the steel.

Ching Yuan Bai[112] et al have studied on low-temperature pack chromization by using proton exchange membrane fuel cell and this study clearly states the performance of 1045 carbon steel modified by activated and low-temperature pack chromization processes, which possess the potential to be bipolar plates in the application of PEMF.

5. MILLING

Danielle et al [13] have studied dry end milling process on AISI 1045, four inputs and six response variables are considered. The normal boundary intersection (NBI) is a multi-objective optimization method mainly developed to compensate the short comings attributed to the method of weighted sums.Theoretical and experimental results indicate that the solution found by NBI-MMSE approach was characterized as a more appropriate optimal point in relation to one obtained with the traditionally weighted sum Luiz Gustavo et al[19] has studied end milling operation on AISI 1045 steel , A central composite experimental design is used to find the surface roughness of end milling AISI 1045, collection of multi variate experimental design and collection of control factors, noise factors and two correlated responses to achieve surface roughness .Nayarit Diaz et al[91] has studied tool wear mechanisms in face milling of AISI 1045, by using DOE Taguchi experiments cutting speed is the most influencing parameter on tool flank wear .I-s Kang [101]et al have studied the cutting force behaviour resulting from the effect of cutting edge radius in the micro-scale milling of AISI 1045 steel using tungsten carbide tools. Experiments are conducted with half-immersion milling that uses micro-milling tools. The feed- and normal direction cutting forces are decomposed into the principal- and thrust-direction cutting forces.

6. BORIDE LAYERS

I.campos-Silva et al [7] have studied boride layers on AISI 1045by power pack boriding process at 1173-1273k, theoretical values of annealing by the extended model are studied .boride layer micro structure with and without substrate are found experimentally. Xiao Xia Lu et al [95] has studied The morphology and types of borides formed on the steel surface were confirmed by optical microstructure, scanning electron microscopy and X-ray diffraction. The results show that the Nd_2O_3 has contrary effects on boriding process, i.e. promotion at high temperatures or hindrance at low temperatures. Nd_2O_3 addition can significantly reduce the activation energy of boride growth at high temperatures.

7. DRILLING

Xiaohoui Nan et al [24] have studied the application of fem for small diameter hole drilling of AISI 1045. The large deformation of work and the chip formation in drilling process is realized by incorporating Johnson-Cook material constitutive model and material failure criterion, stress and strain distribution –optimization of geometry and drilling parameters. Erol kilickap et al [102] has studied optimization of drilling parameters of using response surface methodology.

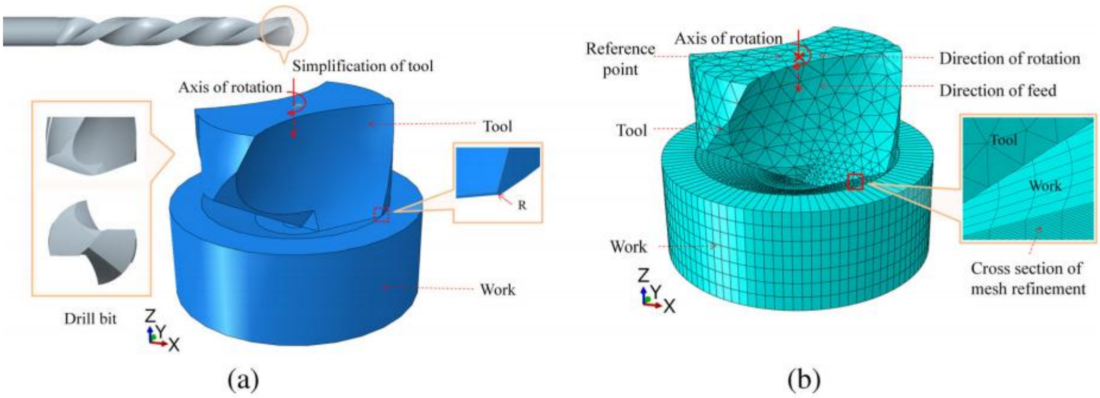

Fig10: Finite element model a) Geometry b) Initial mesh

8. DRAWING

F.Moebus et al [10] has studied high-pressure thermoplastic hose fitting failure analysis, AISI 316L is replaced by AISI 1045 to reduce manufacturing costs Full annealed AISI 1045 steel has low sulphur and its good for cold forming Thomas Karl Hirsch et al [64] Cold-drawn bars were manufactured with different drawing angles and uncoated and TiCN-coated dies. Surface and subsurface properties were investigated along the length and around the periphery of drawn bars. Differences in material states, those affected by the contact zone and those related to the elastic–plastic deformation of the drawing process, were observed.

A.s .Rocha et al [81] has studied redistribution of residual stresses in drawing and final straightening parameters were changed. Both the drawing angle and the angle between the crossed rolls significantly affect the residual stress depth distribution.

9. CRYOGENIC:

R.Thornton et al [51] have studied the effects of cryogenic treatment on the wear development of H13 A tungsten carbide inserts on surface and sub surface wear development during wet machining of AISI 1045. B. Dilip Jerold [68]et al investigate the performance and influence of cryogenic coolants such as CO_2(carbon dioxide) and LN_2(liquid nitrogen) on cutting temperature, cutting force, tool wear, surface finish and chip morphology in machining of AISI 1045 steel compared to wet machining.Surface finish increases and tool wear decreases .B. Dilip Jerold [86] et al have studied to investigate the performance and influence of cryogenic coolants such as co_2 and Ln_2 on cutting temperature cutting force, tool wear, surface finish and chip morphology in machining of AISI 1045 steel compared to wet machining and improvement in surface finish and reduced tool wear. M.Pradeep Kumar [98] et al have studied high-speed machining on AISI 1045 by using cryogenic cooling, co2 reduces cutting temperature than conventional machining, and surface finish is improved.

10. LASER:

S.Martinez [3] et al have studied laser hardening process regarding scanning optics on AISI 1045 steel, the influence of scanning speed and results are known from its variation.To keep nominal temperature value closed loop control is used during experimental setup. Temperature -Time – position evolution in different zones is known by simulation.

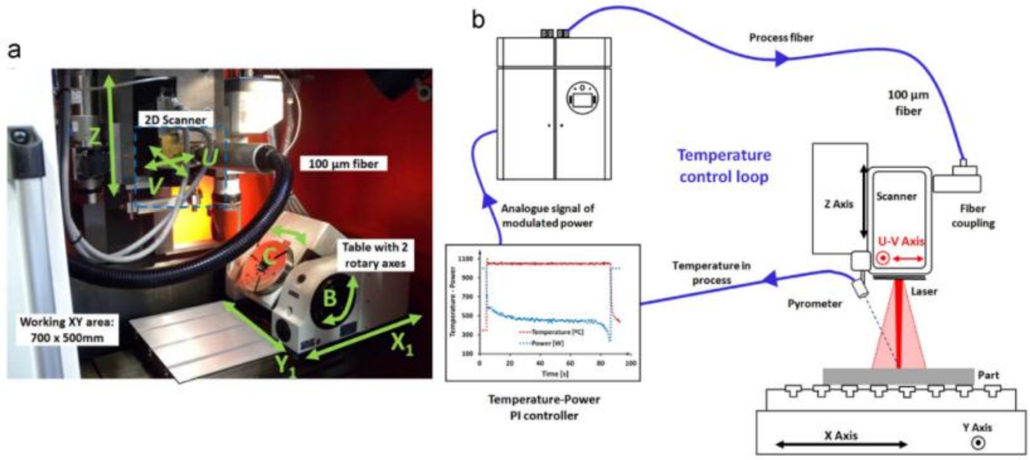

Fig 11: a) axes configuration of laser machining center used for the experiments.

b) Temperature control in the closed loop set up used during the experiments.

Zhe Yang [4] et al have studied the crushing behavior of the SLM printed tube through drop hammer test and FEA.crushing stages are buckling stage and splitting stage. Internal grooves have effects on initial buckling position. Bang ping Gu [5]et al have studied multi dimensional ultrasonic assisted stress relief by using Nd: YAG pulsed laser to relieve residual stresses in the AISI 1045.Reduce energy consumption than MDUSR.Mohammad Lotfi [8] et al have studied ultrasonically assisted drilling with help of simulation to analyze the effect of heat generation on tool faces in the simulation.Intermediate movement of the drill bit and total time in Heat transfer between the work piece and drill bit.Bang ping Gu [18] et al have studied higher order modal characteristics of AISI 1045 with help of high-frequency vibrator system.To know the thermal damage of AISI 1045 steel induced by laser surface treatment to simulate the surface grinding burn. The experimental results reveal that the phase transformation-induced microstructure change, which can be reflected by hardness value, can be regarded as essential of the laser-induced thermal damage.Dong Hyeon Kim [29]et al have studied cutting force and pre heating temperature for laser assisted milling for AISI1045, statistical analysis and regression analysis are known from equations compared to experimental work. Wan Sik Woo[30] et al have studied 3D laser assisted milling to compare with conventional machining .3D work shapes of AISI 1045 are studied .cutting force is reduced and surface roughness is improved. Ruifeng Li [44] et al have studied laser surface hardening comparative between high power diode laser and co_2 laser, heat affected zone below the surface shows a substantial increase in surface hardness.High power diode laser is feasible. R.Aviles [100] et al has studied laser polishing on high cycle fatigue strength, fatigue behavior of AISI 1045 microscopic properties of surface and melting, evaporation of material. J. Static [105] et al has studied surface texturing of metals, The effects of a Ti: sapphire femto second laser with the pulse duration of 160 fs, operating at 775 nm wavelength and in two operational regimes– single pulse (SP) and scanning regime, on a high-quality AISI 1045 carbon steel were studied.

11. HARDENING:

Kia gao [12] et al have studied magnetizer geometry on heating rate and temperature on AISI 1045 steel. Temperature distribution can be improved by increasing the magnetizer width; it becomes worse if magnetizer length increases. Kia Gao [55] et al have studied spot induction hardening to predict material properties of AISI 1045 steel; to predict temperature, hardness, and phase transformation in SIH process by using 3D electromagnetic models by using FEM.

K.Salonitis [34] et al have studied grind hardening process in thermo mechanical response of AISI 1045.Heat generated during the surface heat treatment of work piece through dry hardening and coolant assisted grind hardening. U.Alonso [36] et al have studied grind hardening by control of hardness penetration depth and excessive softness of work piece to be avoided, linear co relation between grinding energy and HPD. Salonitis [56] et al has studied heat generated in the grinding area for the surface treatment of work piece. Residual stresses modeling and prediction through dry grind hardening and coolant assisted grind hardening. Taranveer Singh [61] et al has studied surface roughness of cylindrical grinded and found the optimum set of parameters for roughness. Zhensheng yang [70]et al have studied trail and error method to find out burn threshold.Fourier transform and discrete wavelet transform from level d_1 $_{to}$ d_5 Support vector machine were established in order to identify grinding burn automatically.

12. TESTING

12.1. Fatigue tests:

M.M padzi [57] et al have studied a statistical based analysis of fatigue strain signals to life assessment of AISI 1045 steel by integrated kurtosis based algorithm for Z filter. M. Mohammad [58] et al have studied acoustic emission technique to know fatigue life of AISI 1045.Specific acoustic emission parameters and no. of cycles of failure are correlated to Weibull distribution W.Mocko [60] et al have studied fatigue tests on AISI 1045 through stress controlled tensile loading and analysis of mechanical properties such as elongation and reduction area.

12.2. Microstructures:

Cesar R.N. Nunura [39] et al have studied factors that affect the hardening ability of AISI 1045 steel submitted to jominy end quench test according to austenitizing temperature with CCT reference.Thermo couples are placed in the specimens at predefined points. Equations were obtained by regression numerical methods to estimate the amount of phases and micro-constituents formed during the test, and also to estimate the hardness profile. A.D.Pogrebnjak [54] et al has studied tribological properties ($TiHf_zr_rN_b$) N coating under different deposition conditions by using Ball on disc tribometer.SEM and XRD are used to know the microstructures. Jian Shang [65] et al have made studies on the tribological behavior of columnar grained poly crystalline copper sliding against AISI 1045 in a vertical orientation and horizontal orientation. Grain boundaries and orientation of Vo/Ho cu sample wear mechanism. Z.N.Guo et al [74] have studied electro spark deposition through clad Alcocrfeni high entropy alloy on AISI 1045, relationship to HEA and compared to cu model.Structures are known by the electrochemical test. Zhu Li Na [87] et al have studied magnetron sputtering and low-temperature ion sulfurizing on substrate AISI 1045.Friction and wear test are known through ball on disk wear tester.Ws_2/Mos_2 has low friction better wear than original steel. Zhixing Guo [93] et al has studied microstructure and mechanical properties, WC-5Tic-10c_o ultrafine and conventional cemented carbides are used for AISI 1045. By using ultra fine inserts highest hardness is achieved.

12.3. Corrosion:

Farzad Nasipouri [46] et al has studied oil gas separate vessel damage occurred in steel tube made of AISI 1045.Electro chemical corrosion occurs .protective coating on the inner surface of the tube. The level of damage is known through XRD process. Alejandro orjuela [48] et al have studied thermal reactive deposition on AISI 1045. Niobium carbide coatings are coated to increase corrosion resistance. J.c.Caicedo [88] et al have studied electro chemical behavior of Nano metric multilayer growth on AISI 1045 substrate by polarization resistance technique Mechanical and tribological properties are known by Nano indentation and scratch tests. W.Aperador[107] et al has studied electrochemical behavior on corrosion and erosion resistance on AISI

1045 steel and found multilayer coatings are good. M.M.Verdian [108] et al have studied coatings of NiTi intermetallic coatings by HVOF sprayed on AISI 1045 steel substrate. The coating improves plugging of defects by corrosion products.

Li Na Zhu [110] et al have studied residual stresses in AISI 1045 through Nano indentation method. A new method was proposed to determine the real contact area for pile-up material on the basis of invariant pile-up morphology of the loaded or unloaded states.

13. CONCLUSION SCOPE OF FUTURE WORK:

The review covers recent trends of machining and works carried out on AISI 1045 steel for about one decade. Studies on different cutting conditions and cutting temperature to reduce power consumption can be scope for future work. To reduce the wears during turning process, crater wear and thermal cracks in tools can be studied.

During machining, the occurrence of ASLF in high-speed machining, experimentation and simulation of local heat transfer models at the interface, the chip-tool temperatures and the ways to compensate tool wear to find localized wear on tool can be considered as the scope for future work.

Micro hardness changes and phase transformation during laser treatment process, Numerical simulation of temperature in laser interaction area and cryogenic treatment ON/OFF machining can also be studied.

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