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Effect of acid washing of SiC particles on dispersing and friction properties of Ni-P-SiC composite plating

Norifumi Miyanaga, Shigeaki Minamikawa, Jun Tomioka

School of Fundamental Science and Engineering

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution

Abstract

This study investigated the effect of acidic solutions used in the washing process of SiC particles on the dispersibility of the particles in a nickel matrix. In addition, the friction behavior of the composite plating was investigated by sliding friction tests. As the results, by washing SiC particles with a HCl solution, the particles appeared in clumps and the rougher surface was created. On the other hand, by a HNO_3 solution, the particles appeared with the homogeneous distribution, and thus the surface deposited was smoother. The Ni-P-SiC composite plating shows the lower friction force especially in the range of the slow sliding speed.

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2016 International Conference on Engineering Tribology and Applied Technology

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Message From - H Peter Jost

International Tribology Council

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June 2016

MESSAGE FROM

H PETER JOST

for the 2016 International Conference on Engineering Tribology and Applied Technology - ICETAT2016

Taiwan – 4 - 6th November 2016

Greetings to the Chairman and Members of the Organising Committee and all participants of ICETAT2016.

In the early days, tribology was regarded largely as lubrication engineering. Since then, much in line with the development of the rest of our world, tribology has also developed. It covers not only the lubrication - now approximately 20% of tribology - and very important it is – but also to other friction related areas, multi-disciplinary and defined as *the physical science based generic technology of friction (and wear)*.

As far as industry is concerned, the aim of the work of tribologists is the improvement of productivity, reduction of the use of energy and materials, which are of not unlimited quantities, all ultimately leading to better security and enjoyment of life for all of us.

I suggest to you, the coming generation of wealth creators, that the benefits of tribology cannot be ignored and should be the aim of all of you – for your benefit and for the benefit of your respective countries

Wishing you success for this important ICETAT2016 Conference.

H Peter Jost
President

Forward

To plant a seed, and see it sprout and grow, what an indescribable joy it is to the sower!

It has been forty years since my articles: "On tribology education" appeared in Taiwan's Economics Daily News on May 5th, 1975, and "The resonance of tribology education" appeared in Taiwan's Central Monthly Magazine on August 5th, 1975. As the first person in Taiwan to translate the word "tribology", to see tribology grew from not being widely recognized--the general understanding then was limited to the need to lubricate mechanical devices for friction and wear prevention--to being so widely known and highly valued in so many areas today, my heart is filled with boundless honor and delight!

I would like to welcome all of you, ladies and gentlemen, distinguished participants of the 2016 International Conference on Engineering Tribology and Applied Technology (ICETAT 2016), and to thank all the leaders and colleagues in the organizing team. Thank you for your hard work! With such abundant and excellent research results, ICETAT 2016 will surely achieve the goal of scholarly exchange with great success. Best wishes to all of you!

Respectfully yours,
Ke-Yang Li
The first person to translate the term "Tribology" into Chinese in Taiwan
4th, November, 2016

Welcome Messages

This is my best opportunity to express our warm welcome to all of your participation in the 2016 International Conference on Engineering Tribology and Applied Technology (ICETAT2016). The Taiwan Society of Tribology Technology (TSTT) would like to invite you enjoying the scenery of beautiful capital city - Taipei. This is the 2016 international tribology and applied technology conference held in Taiwan. It has great meaning for us. The objective of this conference is to facilitate close dialogues among experts on issues relating to research and technological development on engineering tribology and other applied technologies.

More than two hundred researchers and contributors from the world submitted about 150 papers. More than 200 registered participants will take part in the work of the ICEAT2016 Conference. The papers accepted for publication have considered containing new developed data or technologies that deserve to be presented in ICETAT2016. Authors from Australia, Belarus, China, Finland, Germany, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Netherlands, Qatar, Thailand, Turkey, United States of American United Kingdom, and Russia are included in ICETAT2016 proving our international orientation.

One hundred and fifty papers presented in the following sessions: Biotribology, Coating, Dynamics and vibrations, Examination and test, Friction, Industrial application, Lubrication, Machine element, Manufacture and surface, Mechanism and manufacture, Micro tribology, Surface and contact, and Wear, etc. We would like to appreciate the authors for submitting their excellent research works to the conference and contributing to the quality of final program. We also acknowledge our profound gratitude to the reviewers for their time, efforts and comments in evaluating the papers, and the distinguished plenary and invited speakers for accepting our invitation. I wish that all of you have a nice stay and wonderful vacation in Taiwan. Good luck with my best regards.

Finally, we will express our sincere gratitude to Ministry of Science and Technology (Taiwan), National Formosa University, National Taiwan Ocean University, TaTung University and Taiwan Society of Tribology Technology for their supports in organizing ICETAT2016 Conference.

Jeng-Haur Horng
Distinguished Professor, National Formosa University
President, Taiwan Society of Tribology Technology (TSTT)
Taipei, Taiwan
November, 2016

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Reverse innovative design from 3D mesh to 3D model of insole shoe orthotic

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ABSTRACT - In the context of today's manufacturing industry, all product innovations are designed and developed using CAD software (Computer-Aided Design). To visualize an insole shoe orthotic product (*iso_product*) corresponding to the contour reliefs malformed legs due to illness (foot deformities) the geometry model of the foot should be described in detail in the form 3D mesh solid. In addition, the designer's *iso_product* are embracing a wide range of digital 3D design application, such as foot IQube 3D scanning, 3D CAD PowerSHAPE 2015, Reverse Engineering, CAE Analysis and Rapid Prototyping CNC machine. This paper will describe in detail the stages of reverse engineering design (RID) to get a pair *iso_product* in people suffering from foot deformity.
The process begins with the initial scan to get a foot in the form of 3D meshes .*STL File*. Scanning is done in a few feet of the Indonesian people over the mid age 40's to 70's and weight range of 30-90 kg and with condition suffering from deformities foot.
Strategy solid modeling as the curved-based modeling that used in this paper to get the 3D surface and solid modeling *iso_product* that fit the relief contour of the scanned foot. In the early stages of this paper the results shown are for normal people's feet, but the future will show some 3D surface and solid modeling and the results of Finite Element (FE) models for people suffering from foot deformities.
Keywords: CAD, CAE, reverse engineering, RID, 3Dmesh solid modeling, solid modeling a curved-based modeling, insole shoe orthotic (*iso_product*).

1. INTRODUCTION

Design is a purpose process involving creative thinking and problem solving. design and knowledge have a very strong association; recollection; and application of knowledge can be considered as a straightforwad and practical design process[1-4].

Product development has moved from physical to digital mockup, and from 2D to 3D design. 3D CAD has become part of a completely digital development process that includes design and modeling (PowerShape, ArtCAM, Toolmaker, copyCAD, PSMold Maker and OrthoCAD), Simulation and tooling (Powermill, featureCAM, ArtCAM, OrthoMill) on Delcam software. On the other hand, with the rapid advancement of 3D data acquisition device, Reverse Engineering (RE) technology has gained wide acceptance, in the design community[1].

As in the times, the engineering design of RE is a technique to design or modify the product by using existing products. RE requires a few tools that are currently being widely grown primarily in companies in the engineering designs often use RE.

RE has a lot also applied to various studies such as that conducted by Ciobanu [6]; Tefler [7], Anggoro [8], Xia [9], T.S. Babu [10] and E. Pipere [11].

This paper will also implement the methods reverse innovative design (RID), which was first introduced by Xiuzi Ye[1] in 2008. The RID method in this paper starts from the process of scanning the human foot to the verification stage design using Abaqus CAE applications 6:13. This paper also use the Tribology analysis because that use CAE analysis using a parameter *iso_product* surface of the foot with which to interact and friction on the use of such products, the results of the analysis are used in the determination of the parameters in the design and development of alternative *iso_product*. RID stages can be presented in figure 1.

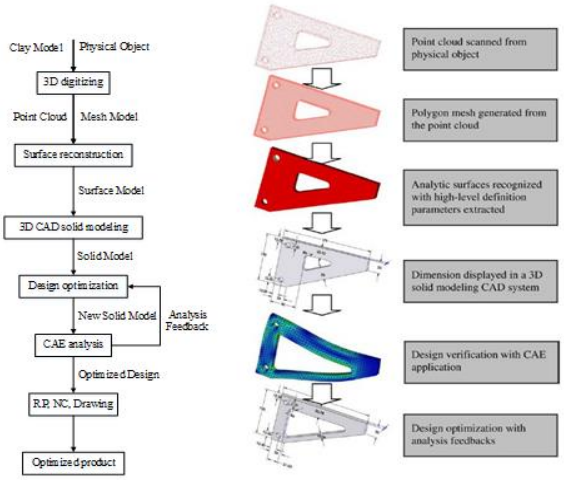

Figure 1. An illustration for RID methodology [1]

2. METHOD

The manual method for designing insole prosthesis requires a skilled and time consuming steps [5,6,9] as in Fig.2. Final alignment of the prosthesis was performed using visual gait analysis and patient feedback.

Figure 2. Traditional method for forming foot insoles[12]

The modern methods for designing insole that requires a process to scanning foot that make a CAD models for CAE analysis.

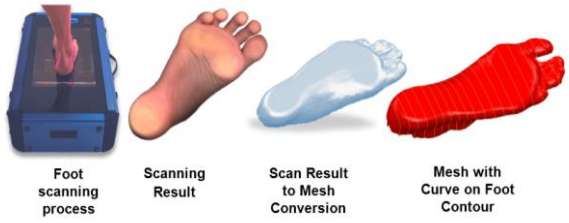

Figure 3. Process scanning the foot with IQube 550

Application of RID in this paper, as the case insole shoe orthotic devoted only starts from the moment the foot scan process using laser scanning IQube 550 reached the stage of 3D solid models ready in verification with CAE Abaqus 6:13.

Figure 1, in front of explaining an illustration of the methodology of process product design using RID. In general, the stages RID [1] for a new product, comprising:

1. The 3D data is acquisition from a physical or clay modeling, point cloud processing and meshing, and mesh processing. The result is a clean mesh models.
2. The 3D solid modeling from mesh with the high-level natural shape definition parameters parameter extracted or product definition, even for free from shapes.
3. Forming a new product models by editing the high level of shape and product definition parameters or by deforming/ editing meshes or surfaces.
4. Performing CAE analysis on new models, modifying and optimizing the new based on feedback from the analysis
5. An optimized digital models from CAE must be output for Rapid prototyping (RP) Flowchart RE in shoe orthotic insole and results of this research can be presented in the figure 4 below:

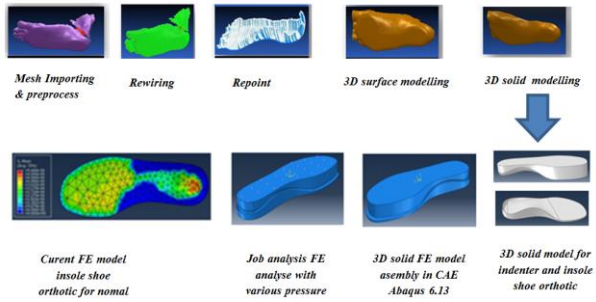

Figure 4. RE insole shoe orthotic modeling

3. RESULT & DISCUSSION

Based on the three scenarios RE modeling strategy that has been described by Xiuzi Ye [1], In this paper, there are two strategy major RE modeling (automatic freeform surface modeling and featured-based parametric solid modeling) is not selected and is not used because the product that can not form a 3D solid as fit the contour of the foot scanning. The second method is very difficult to do given the process used requires precision and expertise in the field of CAD so it takes the long time to design.

CBS-modeling strategy has been chosen by reason of foot contour curves that form can be section curves, and boundary curves, which gives the advantage to the editing process so that the curve formed curves may be generated into the perfect shoe insole surface. The time that required in the establishment of the curve is short by using features create an oblique curve in PowerSHAPE 2015, it will produce curve insole that will automatically fit the contours of the foot that are scanned.

With the method of CBS-surface modeling and smart features in PowerSHAPE 2015 allows a 3D surface can be formed only using curves that have been created.

The figure 4 above shows the stages RE shoe orthotic insole (*iso_product*) using the strategy-base curved surface modeling, 3D solid thus obtained insole with .STL file format that is ready to process the input to CAE with the results of FEA analysis for normal feet. Forward in this paper are shown the results of the design of the design process *iso_product* on human legs Indonesian people that has weight about 40–90 kg, with age 40's to 70's that have malformed leg (foot deformities) like pronation, Metatarsalgia, Flat Feet, neuroma, plantar Fasciitis, Arch Pain, and diabetes.

4. CONCLUSION

This paper was successfully implemented RID application in this paper for the case orthotic shoe insole design (*iso_product*) by integrating 3D digitizing, 3D CAD, RE, and import data and execution CAE meshing process.

CBS-modeling methods were applied to this paper is accord, precise and quickly able to generate and acquire 3D solid modeling *iso_product* in the form of .STL file and capable inputted properly at CAE Abaqus 6:13 software to the 3D mesh and visualization stage.

In the future research can be continued for optimizing process design for foot orthotic insole that is malformed due to diseases such as pronation, supination, plantar fasciitis, high arch, flat feet, Morton's neuroma, Metatarsalgia, and diabetes-related foot problems.

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