出國報告(出國類別:出席國際研討會)

The fifth International Conference on Continuous Optimization (ICCOPT 2016)及 2016 International Conference on Engineering and Applied Sciences(EAS 2016)

國際學術研討會

出國公差報告

服務機關：國立虎尾科技大學

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派赴國家：日本

出國期間：2016.08.05-2016.08.16

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摘要

本次出國參與研討會之目的在於提升研究成果之國際交流與精進研究方法。經由參加『The fifth International Conference on Continuous Optimization (ICCOPT 2016)』及『2016 International Conference on Engineering and Applied Sciences (EAS 2016)』國際學術研討會議，且與參與之其他國家之學者進行交流，並了解目前最佳化技術及工程與應用科學，得到國際交流的能量。

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一、 目的

本次參與新加坡所舉辦之國際研討會之目的為與國際有關最佳化技術及工程與應用科學之國際學者交流且發表論文，並藉由互相交流之過程拓展國際合作之契機。

二、 過程

ICCOPT 2016 國際研討會為 105 年 08 月 06 日至 105 年 08 月 11 日及 EAS2016 國際研討會為 105 年 08 月 14 日至 105 年 08 月 15 日於日本東京舉行，因此本人於 105 年 08 月 05 日啟程、08 月 06-11 日參加 ICCOPT 2016 研討會及 08 月 14-15 日參加 EAS 2016 研討會，08 月 16 日返程，另外 8 月 12-13 日休假之參訪行程，共十日請公差假，簽呈如圖一。

圖二為 ICCOPT 2016 國際研討會之舉辦地點「政策研究大學」，圖三為研討會地點所張貼之海報，圖四為本人參加之研討會，研討會之會議中除了進行發表論文且與學者進行交流，圖五為國際人士交流之照片之相片。圖六為此次發表文章之內容，主題為「Application of FEM and Abductive Network to determine the optimum forging power and billet dimensions of near net-shape spiral bevel gear forging」，齒輪在各類機械中應用極為廣泛的重要傳動零件，以鍛造技術生產螺旋傘齒輪具有節省材料、成品精度佳、成本低、效率高、易於大量生產及機械性質佳等優點，極具產業應用上之價值，若鍛造製程的參數設定能以方便的方法預先模擬，應能有效提高鍛造的實用性。本研究採用有限元素數值模擬技術進行螺旋傘齒輪鍛造塑性成形分析，首先利用有限元素分析軟體來模擬螺旋傘齒輪的近淨形溫間鍛造過程，在不同參數下，如模數及齒數等，分析近淨形鍛造胚料體積、最大成形力及最大等效應力之影響，以及胚料在模穴之流動、變形情況及負荷值等，並製作模具進行實驗，對實驗值與有限元素分析軟體之模擬值進行比較。最後利用類神經網路建構螺旋傘齒輪近淨形鍛造的胚料體積、最大成形溫度與所需最大成形力的預測模式，以此預測模式進行預測，其結果比對有限元素分析結果相當良好。因此對於後續不同螺旋傘齒輪輪鍛造時，可先預測其最大成形力及胚料體積，再選用其較佳之機台噸數及胚料體積，進而達到節省設計開發時間。

圖七為 EAS2016 國際研討會之舉辦地點「HOTEL SUNROUTE PLAZA SHINJUKU」，圖八為研討會地點所張貼之海報，圖九為本人參加之研討會，研討會之會議中除了進行發表論文且與學者進行交流，圖十為國際人士交流之照片之相片。圖十一為此次發表文章之內容，主題為「The ductile fracture analysis of Mg sheet metal forming process at elevated temperature」，其主要是鎂合金有強度高、質量輕、耐衝擊等特性，現在大多朝電子產品外殼發展，由於鎂合金在常溫時塑性變形能力低，不易變形，因此必須升高製程溫度產生新的變形機制。溫間製程有分為恆溫與非恆溫成形，本文研究鎂合金 AZ31 恆溫與非恆溫製程中圓錐杯成形性之差異，發現在非恆溫製程中有較佳的成形性。利用有限元素模擬探討不同模具非恆溫製程之成形性，研究不同製程參數在對成形性之影響，但金屬本身材料之限制，模擬使用破裂準則有助於提高其準確性，並將不同參數分析結果與類神經網路結合，建立預測模組探討不同參數下破裂深度與成形力之結果，有助於減少實驗資源浪費，並利用有限元素模擬與類神經網路預測之結果差異，比較其誤差範圍確認預測準確性，其結果發現建立的預測模型有合理的準確性。

已決行

檔　　號：1903
保存年限：10

簽 於 機械與電腦輔助工程系105年6月22日

聯 絡 人：廖妙齡 （機械與電腦輔助工程系）
連絡方式：05-6315306 #5306
附　　件：附件一 2016 ICCOPT 邀請函.pdf、附件二 2016 ICCOPT 接受函.pdf、附件三 2016 EAS 接受函.pdf、附件四 剛通過國科會產學計畫核定清單.pdf、日本東京-楊東昇老師出國 行程預定表1050621.doc、楊東昇老師簽名.pdf

主旨：擬請准予職(楊東昇)以公差假方式前往日本出席東京國際學術研討會議，敬請 鑒核。

說明：

一、『The Fifth International Conference on Continuous Optimization (ICCOPT 2016)』國際學術研討會議，將於105年8月6日至105年8月11日於日本東京舉行。另『International Conference on Engineering and Applied Sciences (EAS 2016)』國際學術研討會議，將於105年8月14日至105年8月15日於日本東京舉行。

二、職投稿ICCOPT 2016研討會之論文已被接受，邀請函及接受函如附件一與附件二，另職投稿EAS 2016研討會之論文已被接受，接受函如附件三，且獲邀此二研討會做論文發表，擬藉由出席國際會議之機會與國際人士切磋、交流與互動。

三、參加ICCOPT 2016及EAS 2016研討會所需註冊費及旅費約需新台幣12萬元左右，該經費擬由職國科會產學計畫如附件四(可勻支額50,000)及歷年計畫結餘款和管理費(共可勻支額300,000)。

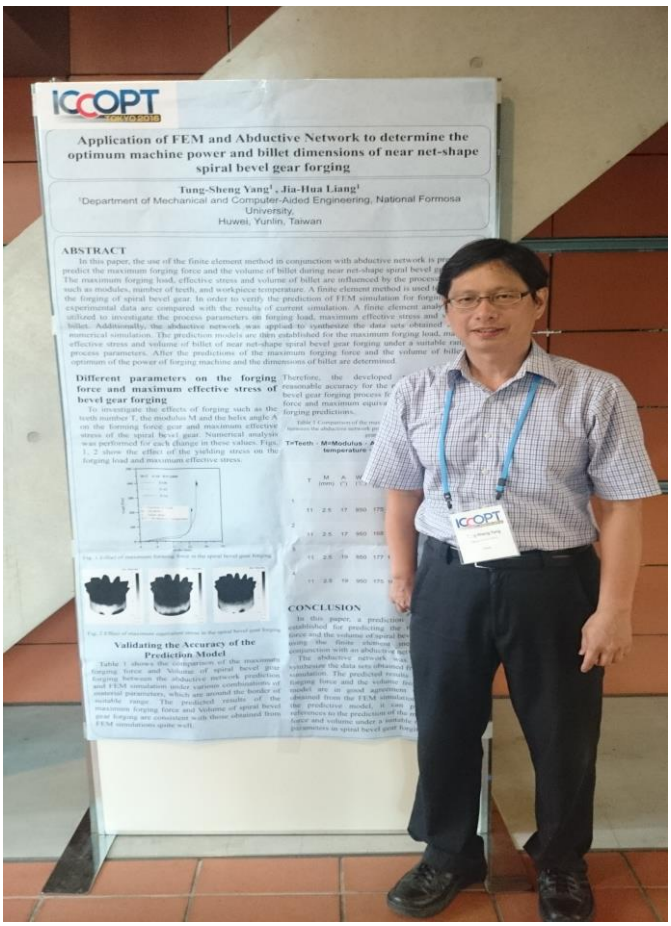
四、因行程及參訪關係，擬准105年8月5日啟程至東京、8月6-11日參加『ICCOPT 2016』，8月14-15日參加EAS 2016研討會及8月16日返程共十日請公差假；另8月12-13日之參訪行程請休假。奉核後即進行辦理後續相關行政事宜。

國立虎尾科技大學
1055100524

圖一 簽呈

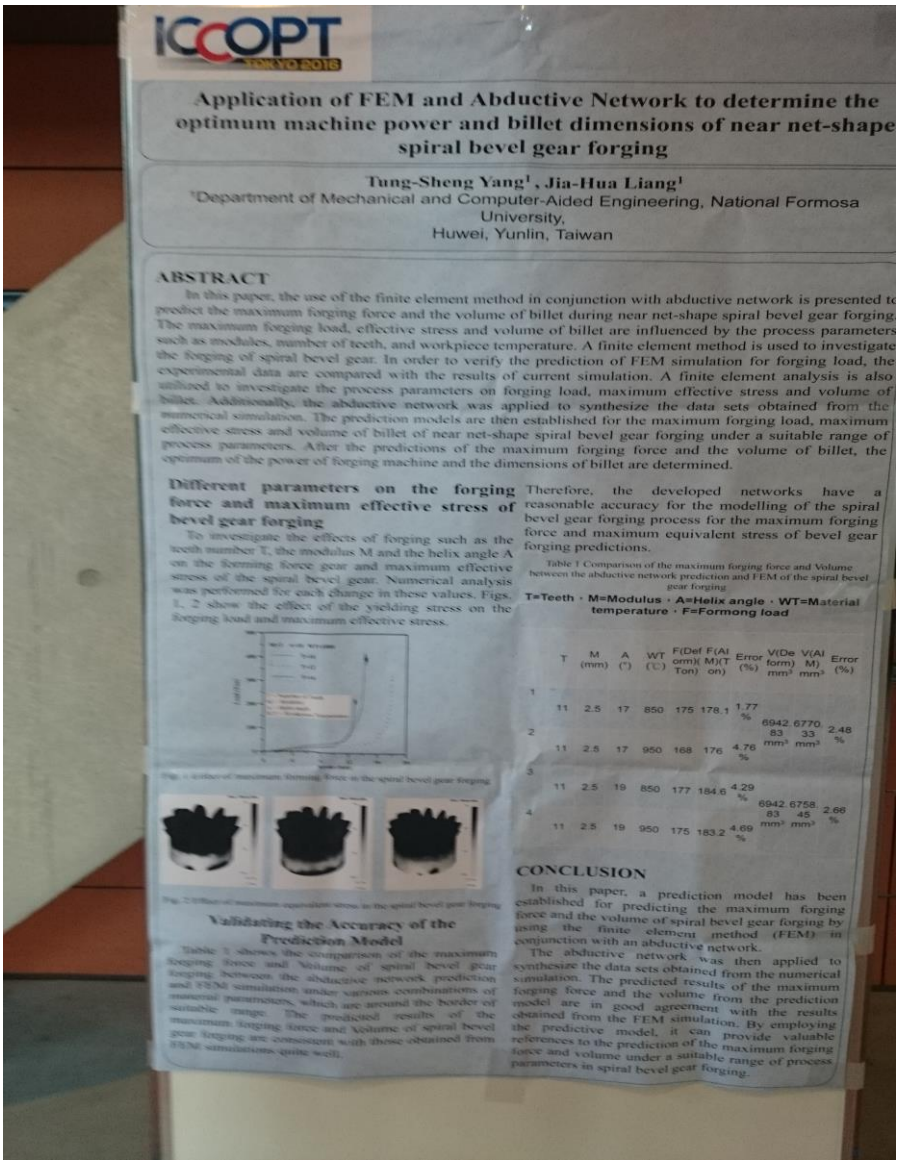
圖二 研討會舉辦地點「政策研究大學」

圖三 研討會海報



圖四 本人參加研討會之照片

圖五 會場參加研討會之國際人士



ICCOPT TOKYO 2016

Application of FEM and Abductive Network to determine the optimum machine power and billet dimensions of near net-shape spiral bevel gear forging

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ABSTRACT

In this paper, the use of the finite element method in conjunction with abductive network is presented to predict the maximum forging force and the volume of billet during near net-shape spiral bevel gear forging. The maximum forging load, effective stress and volume of billet are influenced by the process parameters such as modules, number of teeth, and workpiece temperature. A finite element method is used to investigate the forging of spiral bevel gear. In order to verify the prediction of FEM simulation for forging load, the experimental data are compared with the results of current simulation. A finite element analysis is also utilized to investigate the process parameters on forging load, maximum effective stress and volume of billet. Additionally, the abductive network was applied to synthesize the data sets obtained from the numerical simulation. The prediction models are then established for the maximum forging load, maximum effective stress and volume of billet of near net-shape spiral bevel gear forging under a suitable range of process parameters. After the predictions of the maximum forging force and the volume of billet, the optimum of the power of forging machine and the dimensions of billet are determined.

Different parameters on the forging force and maximum effective stress of bevel gear forging

To investigate the effects of forging such as the teeth number T, the modulus M and the helix angle A on the forming force gear and maximum effective stress of the spiral bevel gear. Numerical analysis was performed for each change in these values. Figs. 1, 2 show the effect of the yielding stress on the forging load and maximum effective stress.

Validating the Accuracy of the Prediction Model

Table 1 shows the comparison of the maximum forging force and volume of spiral bevel gear forging between the abductive network prediction and FEM simulation under various combinations of numerical parameters, which are around the border of suitable range. The predicted results of the maximum forging force and volume of spiral bevel gear forging are consistent with those obtained from FEM simulations quite well.

Therefore, the developed networks have a reasonable accuracy for the modelling of the spiral bevel gear forging process for the maximum forging force and maximum equivalent stress of bevel gear forging predictions.

Table 1 Comparison of the maximum forging force and Volume between the abductive network prediction and FEM of the spiral bevel gear forging

T=Teeth · M=Modulus · A=Helix angle · WT=Material temperature · F=Formong load

	T	M (mm)	A (°)	WT (℃)	F(Deform)(Ton)	F(AI M)(Ton)	Error (%)	V(Deform) mm³	V(AI M) mm³	Error (%)
1	11	2.5	17	850	175	178.1	1.77 %	6942.83 mm³	6770.33 mm³	2.48 %
2	11	2.5	17	950	168	176	4.76 %			
3	11	2.5	19	850	177	184.6	4.29 %	6942.83 mm³	6758.45 mm³	2.66 %
4	11	2.5	19	950	175	183.2	4.69 %			

CONCLUSION

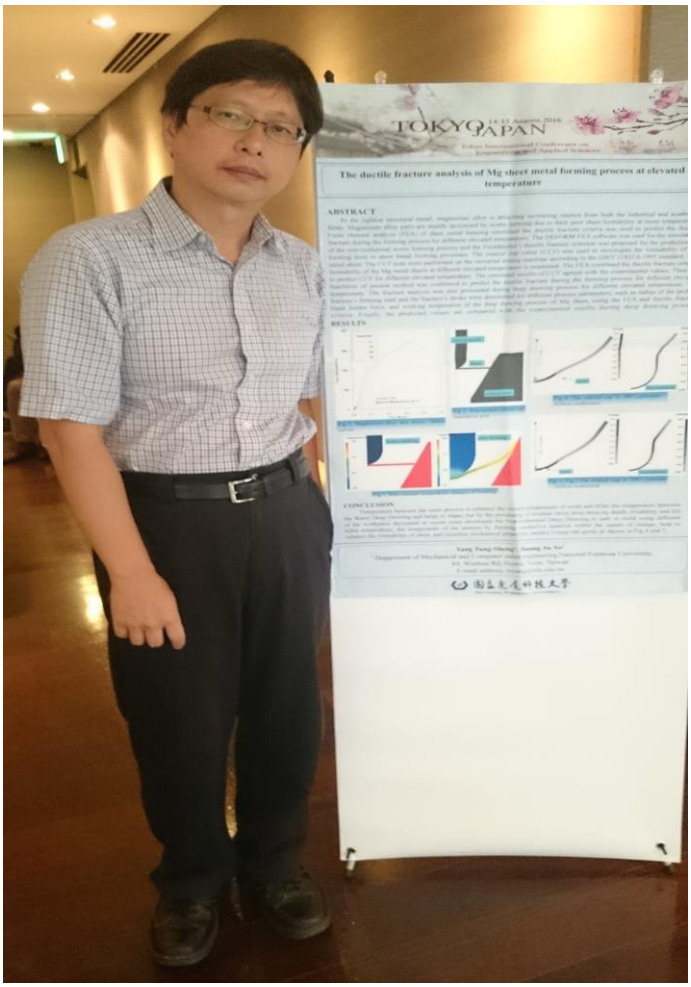
In this paper, a prediction model has been established for predicting the maximum forging force and the volume of spiral bevel gear forging by using the finite element method (FEM) in conjunction with an abductive network.

The abductive network was then applied to synthesize the data sets obtained from the numerical simulation. The predicted results of the maximum forging force and the volume from the prediction model are in good agreement with the results obtained from the FEM simulation. By employing the predictive model, it can provide valuable references to the prediction of the maximum forging force and volume under a suitable range of process parameters in spiral bevel gear forging.

圖六 發表之文章

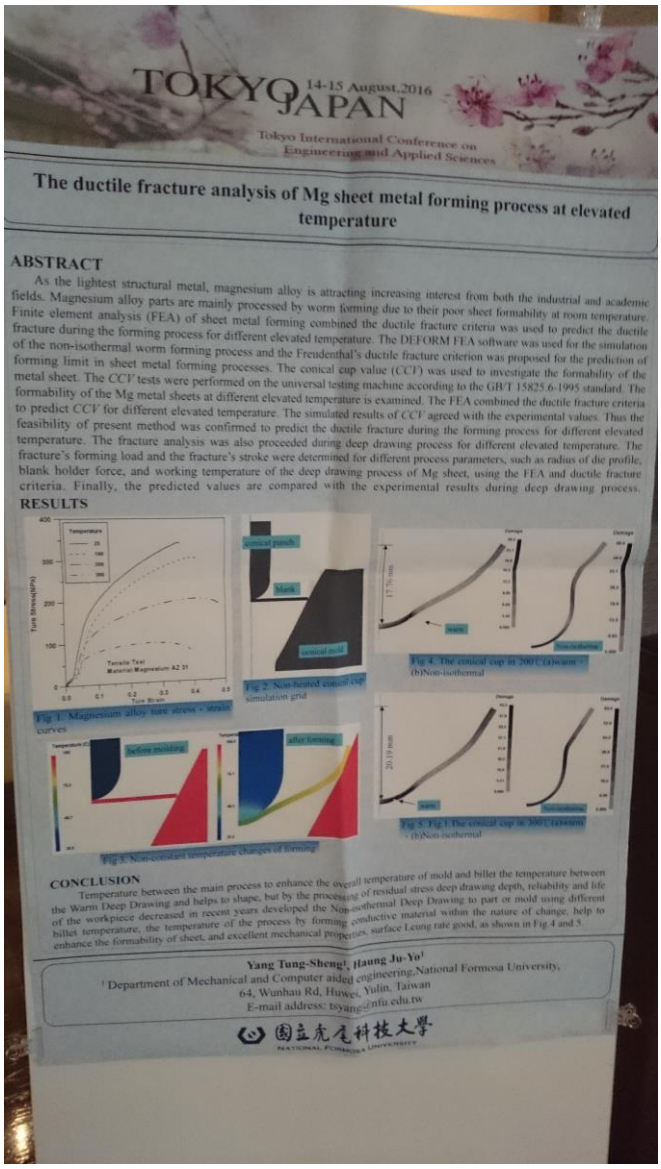
圖七 研討會舉辦地點「HOTEL SUNROUTE PLAZA SHINJUKU」

圖八 研討會海報



圖九 本人參加研討會之照片

圖十 會場參加研討會之國際人士



TOKYO JAPAN 14-15 August,2016

Tokyo International Conference on Engineering and Applied Sciences

The ductile fracture analysis of Mg sheet metal forming process at elevated temperature

ABSTRACT

As the lightest structural metal, magnesium alloy is attracting increasing interest from both the industrial and academic fields. Magnesium alloy parts are mainly processed by worm forming due to their poor sheet formability at room temperature. Finite element analysis (FEA) of sheet metal forming combined the ductile fracture criteria was used to predict the ductile fracture during the forming process for different elevated temperature. The DEFORM FEA software was used for the simulation of the non-isothermal worm forming process and the Freudenthal's ductile fracture criterion was proposed for the prediction of forming limit in sheet metal forming processes. The conical cup value (*CCV*) was used to investigate the formability of the metal sheet. The *CCV* tests were performed on the universal testing machine according to the GB/T 15825.6-1995 standard. The formability of the Mg metal sheets at different elevated temperature is examined. The FEA combined the ductile fracture criteria to predict *CCV* for different elevated temperature. The simulated results of *CCV* agreed with the experimental values. Thus the feasibility of present method was confirmed to predict the ductile fracture during the forming process for different elevated temperature. The fracture analysis was also proceeded during deep drawing process for different elevated temperature. The fracture's forming load and the fracture's stroke were determined for different process parameters, such as radius of die profile, blank holder force, and working temperature of the deep drawing process of Mg sheet, using the FEA and ductile fracture criteria. Finally, the predicted values are compared with the experimental results during deep drawing process.

RESULTS

Fig 1. Magnesium alloy ture stress - strain curves

Fig 2. Non-heated conical cup simulation grid

Fig 4. The conical cup in 200℃(a)warm - (b)Non-isothermal

Fig 5. Fig 1.The conical cup in 300℃(a)warm - (b)Non-isothermal

Fig 3. Non-constant temperature changes of forming

CONCLUSION

Temperature between the main process to enhance the overall temperature of mold and billet the temperature between the Warm Deep Drawing and helps to shape, but by the processing of residual stress deep drawing depth, reliability and life of the workpiece decreased in recent years developed the Non-isothermal Deep Drawing to part or mold using different billet temperature, the temperature of the process by forming conductive material within the nature of change, help to enhance the formability of sheet, and excellent mechanical properties, surface Leung rate good, as shown in Fig.4 and 5.

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圖十一 發表之文章

microstructure of a-C:H films, and the microstructure is changed according to coating methods and parameters. In our previous study, Raman spectroscopy was used to clarify the microstructure of a-C:H films, and the microstructure of a-C:H films evaluated by Raman parameters (G-peak position and FWHM(G)) and the mechanical properties of the films were successfully correlated with Raman parameters. In this study, a-C:H films were prepared on Si wafer using plasma based ion implantation and deposition technique (PBII&D). Hardness of the films were measured with nanoindentor and surface roughness was measured using atomic force microscope. Ball-on-disc type tribotester was used to evaluate friction properties of the films in the air. It was found that the frictional properties of a-C:H films depend on their microstructure, i.e., polymer-like carbon (PLC), diamond-like carbon (DLC) and graphite-like carbon (GLC) structures, and PLC and GLC-structured a-C:H films show lower friction coefficients compared to that of DLC-structured carbon film, which are attributed to surface chemistry and low shear strength of the films, respectively. a-C:H films with DLC structure showed the highest friction coefficient and the friction coefficient increases in proportion to their hardness.

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(MPF8241) Mechanical and tribological properties at elevated temperatures of CrTiSiN composite coating

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In this study, a composite-layered CrTiSiN hard coating was grown and evaluated for mechanical and tribological properties at elevated temperature. A traditional single-layered TiAlN was deposited and used for comparison. After the coatings were synthesized using a cathodic arc evaporation system, they were characterized. Then, the elastic-plastic stress-strain behavior, wear performance and friction behavior at elevated temperature from 100 to 300 ℃ were evaluated. The stress-strain behavior was derived from the comparison between load-displacement and pipe-up/sink-in behavior obtained by the finite element analysis and that by the nano-indentation test. The wear performance was assessed using a wear test. The friction behavior was investigated using a compressing and sliding test. The results showed that for the CrTiSiN coating, its hardness, Young's modulus and tangent modulus increased as the temperature increased. The CrTiSiN coating exhibited excellent anti-wear and low friction performance at elevated temperatures as compared to the TiAlN coating.

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(MPF8263) Effects of SiC microparticles in electrolyte on structure and tribological property of micro-arc oxidation coatings of Ti6Al4V alloys

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Ti6Al4V alloy was widely used in the fields of aerospace and biological engineering for many excellent properties. However, the poor tribological behavior evidently hinders its further application. As an effective method, micro-arc oxidation technique was extensively carried out to improve the tribological properties of various nonferrous alloys because of its prominent advantages. Though wonderful effects were achieved by using micro-arc oxidation method, the typical porous morphology of micro-arc oxidation coating is still a disadvantage in improving the tribological behaviors.

圖 3 投稿摘要部分

心得與建議

本次參與 ICCOPT 2016 及 EAS 2016 會議心得與建議如下：

1. 參加 ICCOPT 2016 研討會，學習利用電腦輔助工程分析及類神經方法可預估成形力大小及鍛造機能量，找出較佳之鍛造機的噸位，透過最佳化方法應用於工程上之預估是值得學習的，藉以提升自己之產學能量及精進研究方法。
2. 藉由此次參觀了解鎂合金冲壓方面先進成形技術，可將特殊合金方面之新知帶給學生，促進教學成效。