Influence of Chemical Etching on Surface Micro-Geometry of Titanium Implants

Anton Martikan[1], Jozef Struharnansky[1], Dana Stancekova[1], Andrej Czan[1], Michal Hatala[2]
[1]University of Zilina, Faculty of Mechanical Engineering, Univerzitna 1, 010 26, Zilina, Slovak Republic
E-mail: anton.martikan@fstroj.uniza.sk, jozef.struharnansky@fstroj.uniza.sk, dana.stancekova@fstroj.uniza.sk, andrej.czan@fstroj.uniza.sk
[2]University of Košice with a seat in Presov, Bayerova 1, 080 01 Presov, Slovak Republic, michal.hatala@tuke.sk

The article deals with influence of chemical etching and polishing on some roughness parameters of titanium parts surface, designed for implantation into human organism. Titanium alloy Ti-6Al-4V was used for the experiment. Analysed samples were created by conventional mechanical machining methods as milling, grinding and polishing. Influence on surface and quantity of removed material by acid solution was analysed. Three methods of sample surface finishing were used, each resulting in variety of surface quality, and then two methods of chemical polishing, differed by reaction time of acid with samples surface. The samples surface was analysed optically, using stereo-microscope and evaluated roughness parameters as arithmetic average roughness *Ra*, ten-point mean roughness *Rz*, profile skewness *Rsk* and kurtosis *Rku* were measured. The modification of these parameters after the reaction was measured and analysed.

Keywords: titanium alloys, implants, chemical polishing, surface micro-geometry

Acknowledgement

The article was funded by the grant project VEGA 1/0773/12 - "Implementation of technical ceramic material research to increase the innovation of hybrid products".

References

[1] CZÁN, A., SAJGALÍK, M., HOLUBJAK, J., KOURIL, K. (2013). Studying of cutting zone when finishing titanium alloy by application of multifunction measuring syste , In. *Manufacturing Technology*, Vol. 13, No. 4, pp. 428-431

[2] MICHALIK, P., ZAJAC, J., HATALA, M., MITAL, D., FECOVA, V. (2014). Monitoring surface roughness of thin-walled components from steel C45 machining down and up milling. In. *Measurement: Journal of the International Measurement Confederation*, Vol. 58, pp. 416 - 428.

[3] NÁPRSTKOVÁ, N., CAIS, J., SVOBODOVÁ, J. (2013). The effect of modification by strontium of the AlSi7Mg0.3 Alloy on the surface roughness. In. *Manufacturing Technology*, Volume 13, Issue 3, pp. 380 - 384.

[4] RUDAWSKA, A. (2010). Adhesive joint strength of hybrid assemblies: Titanium sheet-composites and aluminium sheet-composites Experimental and numerical verification. In. *International Journal of Adhesion and Adhesives*, Vol. 30, Issue 7, pp. 574 - 582.

[5] KOURIL, K., CEP, R., JANASEK, A., KRIZ, A., STANCEKOVA, D. (2014). Surface integrity at reaming operation by MT3 head. In. *Manufacturing Technology*, Vol. 14, Issue 2, pp. 193 - 199.

[6] GÖRÖG, A., GÖRÖGOVÁ, I. (2014). Current concept of geometrical accuracy. In *Research papers Faculty of Materials Science and Technology Slovak University of Technology in Trnava*, Vol. 22., No. 34, pp. 43 - 50.

[7] STANČEKOVÁ, D., ŠEMCER, J, DERBAS, M, KURŇAVA, T. (2013). Methods of measuring of residual stresses and evaluation of residual state of functional surfaces by x-ray diffractometric methods. In: *Manufacturing technology*, vol. 13, no. 4, pp 547-552.

[8] KROLCZYK G., LEGUTKO S. (2014). Investigations into Surface Integrity in the Turning Process of Duplex Stainless Steel, Transactions of FAMENA, vol. 38, 2 pp. 77 - 82.

[9] KROLCZYK G.M., NIESLONY P., KROLCZYK J.B., SAMARDZIC I., LEGUTKO S., HLOCH S., BARRANS S., MARUDA R.W. (2015). Influence of Argon Pollution on the Weld Surface Morphology, Measurement, Vol.70, pp. 203- 213

[10] FERGUSON, S.J. et al (2006). *Biomechanical evaluation of the interfacial strength of a chemically modified sandblasted and acid-etched titanium surface. MEDLINE.*

[11] SADÍLEK, M., KRATOCHVÍL, J., PETRŮ, J.,CEP, R., ZLÁMAL, T., STANČEKOVÁ, D.: Cutting tool wear monitoring with the use of impedance layers. In. *Tehnicki Vjesnik*, volume 21, 3/2014, pp. 639 – 644.

[12] KRAJCOVIC, M., BULEJ, V., SAPIETOVA, A., KURIC, I. (2012). Intelligent Manufacturing Systems in Concept of Digital Factory. In. *Communications - Scientific Letters of the University of Zilina*, No. 2.

[13] PETŘKOVSKÁ, L., PETRŮ, J., KRATOCHVÍL, J.,SADÍLEK, M. (2014). Chip formation during milling of stainless steels. In. *METAL 2014*, pp. 979 - 984.

[14] KUMIČÁKOVÁ, D., GÓRSKI, F., MILECKI, A., GRAJEWSKI, D. (2013). Utilization of advanced simulation methods for solving of assembly processes automation partial tasks. In. *Manufacturing Technology*, Vol. 13/ 4, pp. 478 - 486.

[15] ZEMAN, P., KOVALČÍK, J., VRABEC, M. (2014). Principles of cutting process modelling and new algorithm proposal, In. *Manufacturing Technology*, Vol. 14, Issue 4, pp. 658 – 664.

Paper number: M2015105