Material analysis of damaged breech locking element of machine gun

David Kusmic, Zbynek Studeny, Emil Svoboda
Faculty of Military Technology, University of Defence in Brno. Kounicova 65, 662 10 Brno. Czech Republic. E-mail: david.kusmic@unob.cz, zbynek.studeny@unob.cz, emil.svoboda@unob.cz

Weapons are special systems, which have high demand in terms of reliability, safety and durability especially in the case of automatic weapons. The most stressed parts of weapons are barrels, breech, locking elements etc. This paper si focused on the failure of locking element, which is used for set the breech baffle and for locking of the breech. From the structural point of view the locking element is highly dynamically stressed component. During the shooting cycles are the shocks transferred into these components, therefore specified material requirements of the locking element are needed. The material of locking element must be modified to hard surface with tough core with thickness corresponding to the size and frequency of shocks to prevent the fatigue failure. The manufacturing documentation wasn´t available, therefore the chemical analysis was performed using the GDOES/Bulk method. The results were compared with material standards to determine the Czech steel equivalent. The damaged locking element was metallographically tested, the surface and microhardness testing was performed by Vickers method. The fracture surface morphology was using the light and electron microscopy (SEM) observed.

Keywords: Locking element, material analysis, failure

Acknowledgement

The paper was prepared with the support of the Project for the Development of the Organization of the Department of Mechanical Engineering, UoD "Promoting Research, Science and Inovation in the Field of Engineering".

References

[1] HOLEMÁŘ, A., HRUBÝ, V. (1989). Iontová nitridace v praxi. SNTL, Praha, pp. 178-180.

[2] PYE, D. (2003). Practical nitriding and ferritic nitrocarburizing. 2nd edition, Ohio: *ASM International Materials Park*, pp. 127-129.

[3] SIRIN, S. Y., SIRIN, K., KALUC, E. (2008). Effect of the ion nitriding surface hardening proces on fatigue behaviour of AISI 4340 steel. In: *Materials Characterization*, vol. 59, pp. 351-358.

[4] STUDENÝ, Z., KUSMIČ, D. (2014). Influence Of Inclusions Size On The Nitrided Components Fatigue Life. In: *23rd International Conference on Metallurgy and Materials*. Brno: TANGER Ltd., Ostrava, ISBN 978-80-87294-52-9.

[5] KUSMIČ, D., DOAN, T., HRUBÝ, V., SVOBODA, E. (2013). Vliv plasmové nitridace na vrubovou houževnatost. In: *Transfer*, pp. 55-60.

[6] DOBROCKÝ, D., DOAN, T., KUSMIČ, D., HRUBÝ, V. (2014). The Change Of Notch Toughness Parameters Of Steel After Plasma Nitriding. In: *ICMT´- 2014*, pp. 66-74

[7] ČSN EN ISO 6507-1 (420374): 2006 Kovové materiály - Zkouška tvrdosti podle Vickerse - Část 1: Zkušební metoda.

[8] DIN 50190-3 – Hardness depth of heat-treated parts; determination of the effective depth of hardening after nitriding. Deutsches Institut für Normung E. V., 1979.

[9] DOBROCKÝ, D., KUSMIČ, D. (2015). The Effect of Plasma Nitriding Process on the Change of Dynamic Parameters of Steel DIN 1654/4. *Manufacturing Technology*, vol. 15, no. 1, p. 14-20. ISSN 1213-2489.

Paper number: M201565
Copyright © 2015. Published by Manufacturing Technology. All rights reserved.