Use of Optical and Electron Microscopy in Evaluating Optimization by Material-Technological Modelling of Manufacturing Processes Involving Cooling of Forgings

Ivan Vorel, Štěpán Jeníček, Josef Káňa, Khodr Ibrahim, Vratislav Kotěšovec
University of West Bohemia, Regional Technological Institute, Univerzitní 22, Plzeň, Czech Republic,
E-mail:frost@rti.zcu.cz

From the technological viewpoint, the manufacture of forged parts is a very complex process governed by countless interrelated factors, the most important of which include temperature profiles, and magnitude and velocity of deformation. For a forge shop, a well-established and optimized forging process guarantees sound profit. Given the changing demands of the market, the range of products and the associated manufacturing parameters must be updated frequently and rapidly. In most cases, this means production line stoppages and production capacity losses due to new process development and optimization. Using material-technological modelling, it can be carried out in laboratory conditions instead, without interfering with the production. In this paper, several optimization experiments based on material-technological modelling are evaluated using various optical and electron microscopy methods.

Keywords: Material-technological modelling, cooling optimization, image analysis, scanning electron microscopy

Acknowledgements

This paper includes results created under the project LO1502 Development of Regional Technological Institute. The project is subsidised by the Ministry of Education of the Czech Republic from specific resources of the state budget for research and development.

References

[1] HRUŠKA, Z., DVOŘÁKOVÁ, L. (2015). The Research Results in the Area Of Environmental Taxation of Manufacturing Business Entities in the Czech Republic, *Manufacturing Technology*, June 2015, Vol. 15, pp.339-344, ISSN 1213-2489

[2] MAŠEK, B., JIRKOVÁ, H., MALINA, J., SKÁLOVÁ, L., MEYER, L. W (2007). Physical Modelling of Microstructure Development During Technological Processes with Intensive Incremental Deformation. *Key Engineering Materials*, 2007, Vol. 345-346, No. 1-2, pp. 934-946, ISSN 1013-9826.

[3] PILEČEK, V., VANČURA, F., JIRKOVÁ, H., MAŠEK, B. (2014). Material-Technological Modelling of Die Forging of 42CrMoS4 Steel. *Materiali in technologije*, 2014, Vol. 48, Issue 6, pp. 869-873, ISSN 1580-2949.

[4] VOREL, I., PILEČEK, V., VANČURA, F., JIRKOVÁ, H., MAŠEK, B. (2015). Material-Technological Modelling of C45 Steel Die Forgings. *Procedia Engineering*. (DAAAM 2014), 2015, Vol. 100, Issue C, pp. 714-721, ISSN 1876-6102.

[5] VOREL, I., VANČURA, F., MAŠEK, B. (2015). Material-Technological Modelling of Controlled Cooling of Closed Die Forgings from Finish Forging Temperature. In *METAL 2015 24th International Conference on Metallurgy and Materials*. Ostrava: 2015 TANGER Ltd., 2015. pp. 202-208. ISBN: 978-80-87294-62-8

[6] MAŠEK, B., JIRKOVÁ, H., KUČEROVÁ, L., RONEŠOVÁ, A., MALINA J. (2011). Material-Technological Modelling of Real Thin Sheet Rolling Process. *METAL 2011. 20th Anniversary International Conference on Metallurgy and Materials*, 2011, pp. 216-220. Edit. TANGER Ltd., ASM Int, Mat Informat Soc; CSNMT; VSB-TU. ISBN 978-80-87294-24-6.

Paper number: M2016257
Copyright © 2016. Published by Manufacturing Technology. All rights reserved.