Investigating Dimensional and Geometrical Accuracy of Isothermally Forged Blades

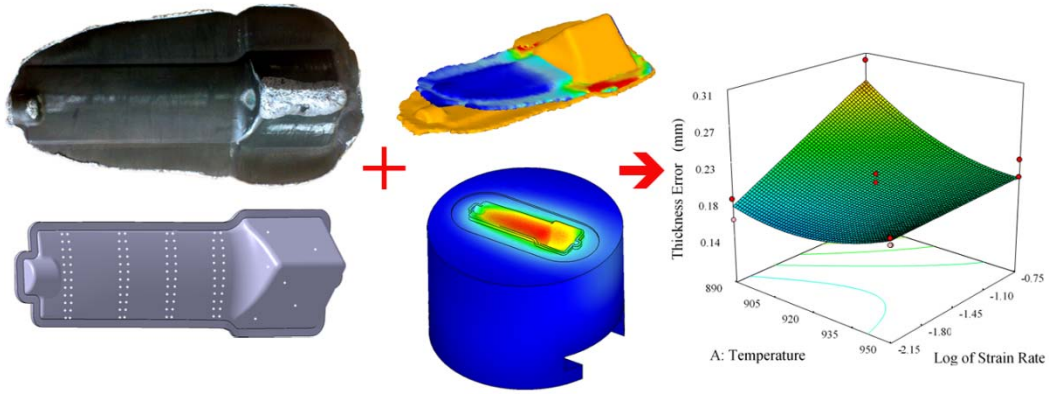
S. Javid Mirahmadi* and Mohsen Hamedi†

* MAPNA Group R&D
MAPNA Group
No. 231 Kajoor, Mirdamad Blvd. Tehran, Iran
Email: mirahmadi_j@mapnagroup.com, web page: http://www.mapnagroup.com

† Faculty of Mechanical Engineering
School of Engineering, University of Tehran
North Kargar St. Tehran, Iran
Email: mhamedi@ut.ac.ir - Web page: http://www.ut.ac.ir

ABSTRACT

Compressor blades are one of the well-known products made of titanium alloys. They are usually manufactured by a forging process followed by several machining processes. Precision forging eliminates a considerable amount of machining; however, due to the close tolerances, the process should be designed in a manner to meet the dimensional tolerances and also the desired mechanical properties. In this paper, effects of two main process parameters, process temperature and pressing speed, on the dimensional and geometrical accuracy of the isothermally forged blades are investigated numerically and experimentally. The results are analysed by the response surface method. In order to justify the results and have a tool for further studies, a coupled thermo-mechanical finite element model is developed and verified by the experimental results. The results show the temperature, speed, and their interaction have a considerable effect on the thickness error; however, the interaction effect of the temperature and speed on the twist error is not significant and moreover the bow error of the forged blades is not meaningful. Finally, the results show that by selection of appropriate process parameters, a sound workpiece with acceptable dimensional and geometrical aspects can be manufactured without any need for a die shape compensation.



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