

Thermo-mechanical fatigue of hot forging tools - prediction, analysis and optimization methods through six-sigma



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(Gust Kuphal)

THERMO-MECHANICAL FATIGUE OF HOT FORGING TOOLS - PREDICTION, ANALYSIS AND OPTIMIZATION METHODS THROUGH SIX-SIGMA



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Shaker Verlag Apr 2014, 2014. Taschenbuch. Condition: Neu. Neuware - Due to the present needs and economical conjuncture, forging companies are obliged to optimize their forging process in order to enhance profits and turn their process more efficient. The tool life increase is an excellent way to amortize the expensive tool costs and manufacture more forged parts per tool set without set-ups needs. Such set-ups occur due to failures on the tools which impossibility further forging processes due to the non-accordance with product specifications. Despite wear being the most frequent failure method found on hot forging tools, cracks are serious failures being one of the most critical one. Furthermore, it has been mainly studied though a qualitatively matter until now due to a lack of prediction models. Hot forging tools experience not only pure mechanical fatigue but, due to thermal stresses, a thermo-mechanical fatigue process. Through the evaluation of thermomechanical fatigue experiments, it has been possible to develop a new method to predict the crack initiation on forging tools through FEM-Analysis. The method consists of a robust and reliable method to predict mechanical and thermal strains responsible for the crack initiation. Industrial results show a 0%-to-2% error on the prediction of crack initiation for hot forging processes with the tool steel 1.2367. With this prediction method, it is possible through the Six-Sigma methodology to analyze quantitatively the most influencing parameters affecting thermo-mechanical fatigue. It has been concluded that the temperature of the billet is the most important factor affecting thermal-strains and the temperature on the tool's surface. By decreasing the thermal load on the tool's surface, it is possible to reduce not only thermal strains but also other modified mechanical properties such as the elastic module that is another important factor. Through one proposed tool life optimization concept, it was...

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