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This article refers to the application of the 3D reverse scanning method for the purpose of analyzing the progressing wear of forging tools as well as detecting forging defects in selected hot die forging processes. By using the POLYWORKS software, the authors developed a numerical algorithm making it possible to determine the volume changes in selected areas of forgings periodically collected from the forging process, in comparison to a reference model. As a consequence of this, two parameters are determined: the positive volume - defining tool wear, and the negative volume - indicating a forging defect, e.g. underfill. Both of these parameters (positive and negative volume) are independent of one another. They can be used to determine the following characteristics: the tool wear curve and the curve indicating the possibility of a defect in forgings as well as disruptions of the production process. The presented approach may be a useful and effective tool which allows a quick assessment of the current tool status and forging quality (without the need for a significant interference in the production process). It may also serve as an instrument for the analysis of the stability and correctness of the production process.

key words: *3D scanning method; hot die forging of automotive parts; tool wear; forging defects*

1. INTRODUCTION

Due to the exceptional difficulty in performing the production process and quality control, the forging industry has long been associated with products of lesser shape and dimensional accuracy. The continuous development of production technologies and high competition between suppliers, particularly on the automotive and aviation markets, demands improvement of the quality and accuracy of the manufactured products. A lot of semi-products made in large amounts and with large geometries, e.g. forging products and tools, must be thoroughly inspected; on the one hand, the geometric tolerances need to be checked, and on the other hand, their mechanical properties as well surface quality need to be examined. In many forging enterprises, fully automated techniques and methods of non-destructive testing are introduced into the production line and constantly developed. This is why measuring methods are constantly being improved; in fact, at each of the individual stages of the entire technological chain of die-forging processes, it is necessary to control and measure the key parameters [1,2]. In each of the listed process stages, there is a potential risk of an error causing forging defects as well failures (Fig. 1).

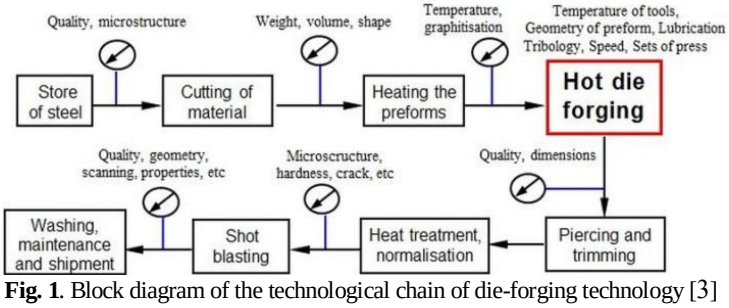

Fig. 1. Block diagram of the technological chain of die-forging technology [3]

In the literature, numerous techniques and ways of non-destructive testing are used in the industrial processes, also in die forging, including ultrasonic testing [4,5,6,7], thermographic testing [8], infrared thermography testing [9,5], tomography [10], visual testing or visual inspection [11], acoustic emission testing (AE) [12,13,14], acousto-ultrasonic testing [1,15], optical testing [17],