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CHARACTERISTICS AND LIMITATIONS OF PHYSICAL TRIBO-MODELLING IN DEEP DRAWING OF THIN SHEET METAL

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Abstract: *The significance of contact friction in deep drawing is well-known, especially in manufacturing of auto body parts. The general approach in this area involves the recognition of the influence of the main tribological parameters – pressure, speed and temperature in the deep drawing process. The developed methods for physical modelling of tribological phenomena and the influence in deep drawing are very different. These methods basically have the appropriate physical model which imitates local area or a complete work piece in metal forming process. The indicators of models can be very different: the deformation forces or work, forming limit parameters, distribution of stress, strain or temperature, etc. This paper analyzes the classic and modern physical tribo-models in deep drawing, according to their characteristics and limitations.*

Keywords: *deep drawing, contact friction, tribo-model, sheet metal, strip drawing.*

1. INTRODUCTION

In deep drawing of complex geometry parts, such as vehicle body elements, various stress-strain schemes may exist in particular zones of the work piece being formed, with tribological conditions influence which might often be complex. On work piece flange, next to pure tangential compression zone, parts without completely curved inner contour have uniaxial tension, which moves to bending field on the die edge. If there are draw beads on the flange, stress scheme gets complicated significantly. As a rule, uniaxial tension is dominant in the wall of the work piece which conveys the forming force. In the specified zones, it is necessary to reduce friction, i.e. to control

friction on flange, in order to control sheet metal moving into die opening.

The influence of tribological factors in deep drawing process is as important as the influence of other main process factors – machine, tools and work piece material [1]. By using appropriate combination of specified factors, it is possible to realize reliable production and obtain high-quality piece.

In physical modelling of deep drawing process, i.e. modelling of contact friction influence, it is necessary to comply with similarities of stress-strain ratios, as well as similarities of main tribological parameters: speed, pressure and temperature on sliding surfaces. Figure 1 shows tribo-models in deep drawing. Basic tribo-models are: sliding

