ADJUSTABLE DRAWBEAD AND VARIABLE CONTACT PRESSURE AS TRIBOLOGICAL INFLUENCES IN SHEET METAL STRIPE SLIDING TEST

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ABSTRACT

The paper presents the experimental analysis of the influence of variable drawbead height and variable contact pressure on drawing force in thin sheet metal stripe drawing test. For the needs of experiment, a computerized device was made which enables the accomplishment of previously specified functional dependencies of drawbead height and contact pressure on duration of stripe drawing process. It is possible to monitor the simultaneous influence of friction conditions (dry or application of lubricant), drawbead roundness radius (2mm and 5 mm), 10 functional dependencies of drawbead height and 10 functional dependencies of contact pressure on drawing force of sheet metal stripes made of various materials. Stripe dimensions are 250 x 30 mm, and drawbead thickness is 10 mm. Maximal pressure value is 20 MPa, and maximal drawbead height value is 8 mm.

Within the results presented here, the influence of two types of variable pressure function in combination with one constant value and two variable drawbead height functions are monitored. Dependencies of drawing force indicate the possibility for applying the specified influences in order to correct the forming process course in computer simulations and systems for deep drawing processes control.

KEYWORDS: Sheet metal, Stripe test, Variable pressure, Adjustable drawbeads

1. INTRODUCTION

The process of deep drawing of thin sheet metals is influenced by many factors, but they can all be adjusted before the beginning of the forming process, with the exception of two factors which can be controlled during the process. Those are - contact pressure on work piece flange and drawbeads height /1/. Controlling of both parameters requires rather complex devices. Optimal functions of pressure and drawbeads height are not easy to define, especially if the drawing depth and work piece quality are set as a criterion. By knowing the concept of those functions well, it is possible to upgrade the results of forming process by applying somewhat simpler equipment (tools and machines) with smaller investments. Such systems are usually called open-loop and they need control devices only for realization of previously defined pressure and drawbead height functions /2, 3/. Active systems, which need constant dynamic feedback between the given function of the objective and controlled and controlling variables throughout the process, are much more complex. The functions of the objective and controlled variable can be different: wrinkle height, thinning in critical zone, flange displacement, flange thickness change, friction force, forming force, stress in work piece wall etc. The given objective functions are defined either by computer simulations or by previous experiments. Pressure on flange and drawbead height are the controlling actions. This requires high velocity of reacting to controlled values change and robust controlling hardware and software apparatus, which implies significant investments /4, 5/.

Application of drawbeads on work piece flange at deep drawing of complex geometry parts is not an innovation. The use of fixed drawbeads and constant blank holding force on flange are