INFLUENCE OF VARIABLE DRAWBEAD HEIGHT AND VARIABLE CONTACT PRESSURE IN AL ALLOY SHEET STRIP DRAWING PROCESS

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ABSTRACT

An electro-hydraulic computer controlled device was created for the realization of the sheet metal strip drawing test. Its main property is realization of contact pressure and drawbead height as different functions dependent on stripe travel or time. In addition, it is also possible to measure drawing force, pressure, drawbead displacement etc.

Experimental study of chosen drawbead height and contact pressure functions influence in strip sliding test are presented in this paper. The strips are made of Al alloy sheet metal AlMg4.5Mn0.7 of 0,9 mm thickness. Strip dimensions are 250 x 30 mm. Drawbead geometry, with rounding radii of 2 and 5 mm, is also varied. Drawbead thickness is 10 mm. On contact surfaces mineral oil was applied.

The results indicate that acting of combined action of constant pressure with variable drawbead height and constant drawbead height with variable contact pressure, in addition to other conditions, can influence substantially the plastic flow process.

KEYWORDS: Al alloy sheet metal, Strip test, Variable pressure, Adjustable drawbeads

1. INTRODUCTION

In order to succeed in deep drawing process control, it is necessary to select, out of a large number of influential factors, the ones which can be varied during the forming process course, thus correcting it until it is completed successfully. There are only two such factors: contact pressure and drawbead height /1/.

Process control through active complex (closed-loop) systems requires permanent dynamic feedback between the given goal function, controlled and controlling variables. The goal functions and controlled variable can be different: wrinkle height, thinning in critical zone, flange motion, flange thickness change, friction force, forming force, tension stress in work piece wall etc. Contact pressure on flange and drawbead height present the controlling variables. High velocity of reacting to controlled values change and robust expensive controlling apparatus in hardware and software meaning are required, which all implies significant investments /2, 3/.

There is also the alternative – a much simpler approach – suggested in this paper. However, first it is necessary to define optimized functions of pressure and drawbead height according to proper criterion (drawing depth, piece quality etc.). This often requires comprehensive experiments /4, 5/ in order to identify the character of specified factors influence. With such information, it is possible to form the controlling apparatus for practical application whose main objective is to realise previously defined optimal functions of pressure and drawbead height. Such equipment requires considerably smaller investments regarding hardware and software and is far more accessible to a wide range of users, for example small enterprises.

Application of constant height drawbeads is still most often applied and well known /6, 7/. Similarly is valid for application of constant blank holding force on flange. The main reasons for