

Variable Contact Pressure and Variable Drawbead Height Influence on Deep Drawing of Al Alloys Sheets

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The process of deep drawing is influenced by many factors. During the forming process, only two of those factors can be controlled. They are blank holding force and drawbead height. Realisation of such control requires relatively complex computerized apparatus.

For this experimental research, electro-hydraulic sheet-metal strip sliding device has been constructed. Basic capacity of realized device is obtaining contact pressure and drawbead height as functions of time or stripe displacement. Additional features consist of the ability to measure drawing force, contact pressure, drawbead displacement etc.

Presented in the paper are the results of influencing of increasing and decreasing drawbead height functions in combination with increasing-decreasing function of contact pressure. Stripe material is aluminium alloy AlMg4,5Mn0,7 sheet metal. Contact condition are additionally influenced by application of mineral oil or completely dry tool and stripe surfaces. Drawbead geometry, with rounding radii of 2 and 5 mm, is also varied.

The accomplished results indicate that simultaneous effects of variable drawbead height, variable contact pressure, tool geometry and appropriate friction conditions can influence the plastic flow process in line with desired change of forming force.

Utjecaj promjenljivog kontaktnog tlaka i promjenljive visine zateznog rebra na duboko vučenje limova od Al legura

Izvorno znanstveni članak

Na proces dubokog vučenja utječe više faktora. Tijekom trajanja procesa oblikovanja moguće je upravljati samo s dva faktora. To su sila držanja i visina zateznog (vlačnog) rebra. Ostvarivanje takvog upravljanja zahtjeva relativno složenu kompjutoriziranu aparaturu. Za ovo pokusno istraživanje razvijen je elektro-hidraulički uređaj za klizanje traka od lima s kompjutorskim upravljanjem. Njegova osnovna karakteristika je ostvarivanje kontaktnog tlaka i visine zateznog rebra, kao funkcijskih ovisnosti o vremenu, odnosno hodu trake. Pored toga, moguće je mjeriti vučnu silu, silu pritiska, pomak rebra itd. U radu su izloženi rezultati ispitivanja utjecaja opadajuće i rastuće ovisnosti visine rebra u kombinaciji s rastuće-opadajućom funkcijom kontaktnog tlaka. Materijal trake je legura aluminija AlMg4,5Mn0,7 debljine 0,9 mm. Na kontaktne uvjete se dopunski utječe s dva tipa trenja. U prvom slučaju površine su suhe, a u drugom se primjenjuje podmazivanje odgovarajućim mineralnim uljem. Geometrija rebra se mijenja preko polumjera zaobljenja 2 i 5 mm. Ostvareni rezultati pokusa pokazuju istodobno djelovanje promjenljive visine rebra, promjenljivog kontaktnog tlaka, geometrije rebra i odgovarajućih uvjeta trenja, mogu utjecati na proces plastičnog tečenja u skladu sa željenom promjenom sile oblikovanja.

1. Introduction

Deep drawing process is widely applied in modern industry, which makes it extremely important. That is the reason for ongoing tendencies to accomplish total control of forming process. In order to succeed in that, it is necessary to select, out of a large number of

influential factors, the ones which can be influenced throughout the forming process, 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 systems requires constant dynamic feedback between the given goal function, controlled and controlling variables [2].

