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IMPORTANCE OF STRAIN ANALYSIS IN TRIBO-MODELING IN DEEP DRAWING

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ABSTRACT

In deep drawing of parts of irregular geometry made of thin metal sheets, as for instance are the parts of car body, in certain zones of the part exist significant differences in stress-strain schemes. Also, significant are differences in the way of realization of the contact between the metal sheet and tool, namely in the contact macro geometry, values of pressure, speed and temperature, friction is useful in certain zones, and in others it is not, etc. In that sense several physical tribo-models were developed, elementary and complex ones, that are related to characteristic zones of the piece that is being drawn: sliding between the flat surfaces of the die and the holder, sliding over the draw bead, bending with tension over the die edge, two-way tension-stretching under the front of the drawing tool, and pure deep drawing in the zone of tangential compression on the flange (1).

Results of tribological investigations can be divided into three groups, according to the nature of parameters that represent the measured variables in realization of corresponding modeling.

The first group consists of physical variables, that are presented as function of pressure, speed, temperature, etc. (friction force and coefficient, roughness parameters, sliding length in galling tests, weighting amount of wear, etc.).

The second group consists of the so called macro-indicators for the whole piece, and their relations, for example the drawing force, the blank holding force, limiting drawing ratio, average friction coefficient, limiting drawing depth, etc.

The third group of parameters is directly related to realized strain fields on the drawn pieces and for their determination one assumes knowledge of strain analysis . In experiments are used the measuring grids, that are being applied to sheet metal surfaces by the special procedure before drawing (2). Strain distribution is being determined for the characteristic section area, or the complete piece that is being drawn.

By its structure and nature, parameters of this group belong to the "interior" indicators and in direct way describe effects of tribo-effects in deep drawing. In experiments were used different materials for deep drawing, several lubricants, different geometries of blank and tools, strain rates and specific pressures in contact. For characteristic models- stretching and pure deep drawing - are enumerated results of the principal strain distributions as function of location, with indicators of the distribution homogenity, distribution gradient, etc., for different contact and other conditions (Fig. 1). Strain distributions in forming limit diagram enable determination of the plastic reserves, strain paths etc. Also, given are the results of influence of contact conditions for non proportional forming, that exists in multi-phase deep drawing (Fig. 2).

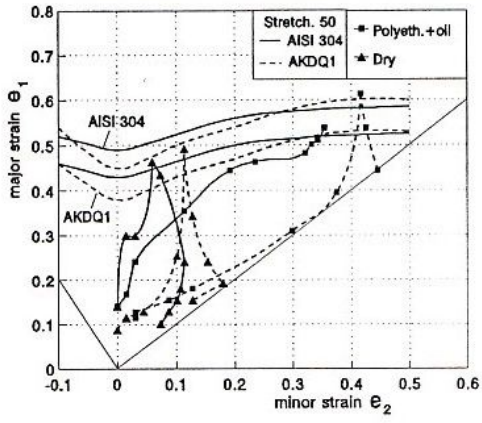

Fig. 1: Strain distribution in FLD for AISI 304 and AKDQ1 steel sheets

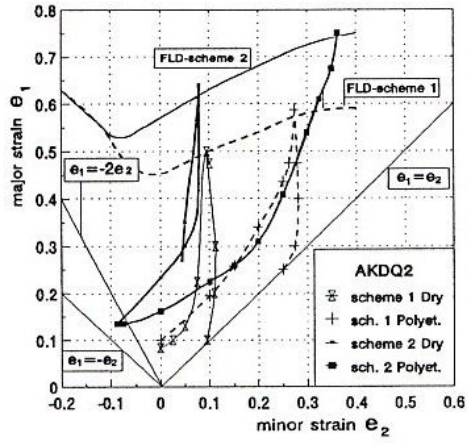

Fig. 2: Strain distribution in FLD for different strain paths (AKDQ2 steel sheet)

REFERENCES

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