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Design and analysis of trimming tool to prove the identical scissor band for cutting inserts

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ABSTRACT

Cutting tools like blanking and trimming operations are used to cut sheet metal parts to form various complicated shapes, which further being used in BIW structures. This operations demand HCHCR material inserts with 55-58 grade of hrc. for cutting purpose. These materials are costly in market and also needs cost effective processes like machining and hardening to make it enabled to cut any sheet metal sheets. While designing inserts for trimming operations selection of cutting land and cutting band (combined form scissor band) effects on working life of specific tool. Improper scissor band will result in blunting and chipping of tool resulting in bad quality of product output & reduced life of tool itself. This study will help in estimating the identical scissor band for cutting to improve the working life of tool. Study include designing of trimming tool in CATIA V5R25 and analysis of maximum cutting strength of tool on ANSYS 12 using variable scissor band & variable sheet thickness of material. Further comparison of analyzed data provide approximate identical scissor band of trimming tools.

Keyword: *- Trimming tool; Cutting land; Cutting band; Tool life; Analysis of trimming tool; Sheet metal machining.*

1. INTRODUCTION

In sheet metal cutting the quality of profile cut and cutting or trimming tool life depends on tool material and tools dimensions. Tool dimensions include from scissor band (formed by inclusion of two perpendicular faces called cutting land & cutting band) to overall dimensions of tool. This study is mainly focused on scissor band of trimming tool. Because scissor band is a main functional area of trimming tool which cut a sheet metal. Improper design of scissor band may lead in tool failure by blunting and chipping of tool.
Here in study D2 material with 55-58HRC is considered as tool material for testing as D2 material is mostly trusted among HCHCR family for cutting tool purpose. Sheet metal cutting is widely used in BIW manufacturing, that's why test material is chosen as JAC270. JAC270 is mostly used material in BIW manufacturing so it is considered as test material for study. Study includes stress formation on scissors band of trimming tool at the time of cutting material with different cutting bands.
CATIA V5R25 is being used to develop 3D model of trimming tool & further ANSYS 12 software is taking in consideration for analysis purpose. For analyzing FES being formed & loaded under static loading on cutting edge. Same testing will be performed on various cutting bands & readings will be compared to estimate identical scissor band of trimming tool that we can consider in our manufacturing processes.

a. About D2 material

D2 material is high carbon high chromium (HCHCR) cold work steel. It contains 1.5% carbon, 0.3% silicon, 12% chromium, 0.8%molibdenum & 0.9% of vanadium. It is mainly used in cutting & forming tools as it has high wear & abrasion resistance properties. D2 steel is processed by hardening it to 750-780^{o}c & quenched in oil bath followed by tempering on 350-400^{o}c to achieve hardness of 55-58 hrc. It is available in market in the form of flat & square stocks, hot rolled rounds and bright drawn rounds in metric & imperial sizes.

b. Process of trimming or shearing action

Any trimming operation of sheet metal forms in three stages namely

1. Plastic deformation
2. Penetration &
3. Fracture

After elastic limit of material exceeds plastic deformation takes place. Driving forces from punch or upper cutting steel forced material to penetrate along die wall. The last stage of cutting is fracture; in this stage material get splitted into two parts.

2. PROBLEM STATEMENT

The major problem dealing in this study is deceased life of cutting or trimming tools due to improper design of scissor band of cutting inserts. Product quality also gets affected by improper scissor band.

3. SIGNIFICANCE OF TOPIC

This topic is important in the term of increasing life of cutting inserts and reducing cost on frequent re-sharpening of tool.

3.1 OBJECTIVES

This study is dealing in static loading analysis on press tool cutting inserts to identify its optimal cutting land in term of increasing its durability.

4. HYPOTHESIS

After completion of this study we can get an identical cutting land for inserts in specific loading condition.

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