Tool-Tips

Ask Dayton Progress

Reader Reply

This month’s Tool-Tip is an answer to a question submitted by a subscriber.

Question: What is “die breathing” within a tool? What causes it?

Answer: Die breathing is also known or referred to as “die flexing”. This is a condition in which the die is moving during the press cycle. Several reasons exists which may contribute to this condition. In some case the entire die may move out of location because the T-bolts holding the die to the ram bolster are loose or worn. The die may be flex or bow because there an inadequate number mounting/restraining bolster bolts. Dies can also breath due to binding issues number mounting/restraining bolster bolts. Dies can also breath due to binding issues. Improper cam dwell can also contribute to die flexing. Inadequate die spring section. Improper cam dwell can also contribute to die flexing. Inadequate die spring or nitrogen spring pressure preventing die detail separation, too light of spring stripper or draw form pressure.

An Innovative Shearing Process for AHSS Edge Stretchability Improvements

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Abstract

A beveled shear hole piercing process has recently been developed for advanced high strength steel (AHSS). The preliminary results have shown the new process is able to improve the quality of the sheared edge and the edge stretchability of AHSS. The goal of the current study is to optimize the beveled shearing process and identify the optimal shearing conditions for AHSS. Four different advanced high strength steels, including DP600, DP780, TRIP780 and DP980 with various thicknesses together with a conventional high strength steel, HSLA50, are selected in this study. The hole expansion test is used to evaluate the effect of shear edge conditions on the edge stretchability. The Results show that an optimal selection of the die clearance and the shearing angle results in a less damaged edge, which significantly delays edge fracture in the forming process and increases the edge stretchability for AHSS. To further validate the advantages of the beveled shearing process in improving the edge quality of AHSS, a straight edge shearing device with the capability of adjusting the shearing variables (rake angles and die clearance) with respect to different sheet thicknesses was also developed and built. The edge stretchability of the straight edge sheared specimen was then evaluated using the sheared edge tension test. A similar trend to the beveled shear hole piercing process of AHSS is observed, and a significant improvement in the edge stretchability is also obtained with optimal shearing conditions.

Introduction

Edge fracture is one of the major issues for stamping Advanced High Strength Steel (AHSS). In addition to the material properties, the quality of the shear edge can directly affect the stretchability and flangeability of AHSS. The applications of high energy cutting methods such as laser cutting and water jet cutting are limited in production due to the high cost and the conventional die cutting process is still used in shearing / blanking the AHSS sheet steels in production. It is widely known that the edge fracture issue is directly related to sheet metal shearing processes. The burrs and micro cracks resulting from the conventional shearing process could serve as the fracture initiation site during forming. Nakata et al. [1] studied the shear deformation properties and the damage behavior on both low and high strength steels using a conventional shearing die. They found that the cutting clearance was critical in trimming high strength steels. The experimental comparison in the edge stretchability of AHSS among standard punched hole, drilled hole and laser cut hole was conducted by Konieczny [2] and Karelova [3]. Results showed that better edge stretchability could be achieved using a bet-

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ter shearing process. Golovashchenko [4] modified the conventional shearing process by adding an elastic pad underneath the blank, which would reduce burrs in a wide variety of clearances without deteriorating the total elongation or edge stretchability. However, the value of the elongation was lower than that observed from the conventional shearing process. The shearing process was also modeled using different Finite Element Analysis (FEA) models [1,5,6,7], but the simulation results were in limited agreement with experiments. Although some limited data and information or guidelines might be available on the optimal shearing variables set up in the shearing process, they are often based on conventional sheet steels with lower strength, higher ductility and more homogeneous microstructure, which may not be suitable for shearing AHSS.

The objective of this research is to develop the optimal shearing variables for AHSS to improve the quality of the sheared edge based on the stretchability or flangeability of the sheared edge. Ultimately, the goal is to delay edge fracture in the forming process and improve the AHSS edge stretchability. To simplify the number of shearing variables, a beveled shear hole piercing process was developed in a recently study [8]. The preliminary results showed that the optimal shearing condition was capable of improving the sheared edge condition. In this study, the beveled shearing method is further investigated using different AHSS with different thicknesses, and the hole expansion test [2,3,9] is used as an edge fracture test to evaluate the edge condition of the beveled sheared hole edge. Furthermore, by extending the beveled shearing methodology in hole piercing, a straight edge shearing device is developed to study the effectiveness of the beveled shearing method in straight edge shearing. The edge stretchability is then evaluated using a sheared edge tension test [10,4,11,12]. Finally, the effects of straight sheared edge conditions on the edge stretchability are also discussed for various AHSS.

References


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