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Author Chien-Yu Lee
Author's Email Address No Public.
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Abstract
Flange height and lip thickness are constrained by the forming limitation of the sheet metal in hole-flanging. Wall thickness is reduced and inner corner tends to be rounded during the operation. Excessive drawing force usually causes necking or fracture in the sheet metal blank prior to the flange reaches the desired height. This hinders the workpiece from subsequent assembly.

A one-piece part of “turntable/spindle motor” for slim type DVD is used as the vehicle in adopting multi-action extrusion for the hole-flange stamping die-set. This design incorporates a punch to compress the blank from its outer edge while a movable die holds the wall to prevent it from buckling in the course of compressive forming. Hence a greater flange height can be achieved without reducing wall thickness. The round corner is cured subsequently by pushing back the flange with a taper die and the upright angle is thus formed.

DEFORM 2-D, an FEM software for metal forming simulation, is applied in optimizing the die design. The factors affecting the formability include the speed of the pin design, die radius/taper angles, and the friction of the movable die. In obtaining upright angle at the flange bottom, die angles of the previous stage and the taper die are investigated. The results are tabulated in a non-dimensional form which can provide the die designers as a universal guideline.

The multi-action extrusion and upright-corner forming of flange can be broadly applied to the production of axis-symmetric parts. With the advantages of better quality and minimized process lead, production cost can be reduced and therefore the competitiveness of the domestic industry be improved.
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